Conditions in the Drop Forging Industry 1954-1964

CORRECTIONS

Page 8, last para, line 2—amend " boiling point: 196°C." to read " boiling point–196°C."

Page 12, fourth para, line 3—delete " in ".

Page 22, fifth para, line 4—after " from " insert " which ".

Pages 52 to 61 inclusive, footnote (*)—amend " 46 " to " 51 ".

Pages 52 to 56 inclusive and page 58, footnote (†)—amend " 44 " to " 50 ".

Ministry of Labour
August 1966

LONDON: HER MAJESTY'S STATIONERY OFFICE

To: The Rt. Hon. R. J. Gunter, M.P.,
Minister of Labour

Introduction

1. In June 1951, a small Committee was invited to consider "working conditions in the Drop Forging Industry in respect of the Safety, Health and Welfare of persons employed and to draw up an Agreement specifying the minimum standard for compliance with the requirements of the Factories Acts 1937 and 1948, together with recommendations in respect of any associated matters". The Committee's report was published in 1953, one of its principal recommendations being that the consultations in the industry between employers and workers and H.M. Inspectors of Factories which had begun with the Committee should continue in some form. As a result the Joint Standing Committee on Health, Safety and Welfare in the Drop Forging Industry was set up in September 1954 by H.M. Chief Inspector of Factories. Twelve meetings were held until, in April 1961, the Committee was formally reconstituted by the Minister of Labour in pursuance of his new powers under section 25(2) of the Factories Act 1959. Nine meetings have since taken place.

2. At each meeting the half-yearly accident figures have been examined and, wherever possible, measures for prevention of accidents have been put forward for the consideration of both the industry and H.M. Chief Inspector of Factories. Reports on technical developments in the United States and in Europe, as well as at home, have been considered.

3. In 1963, to mark the tenth anniversary of the publication of the first Committee's report, the Joint Standing Committee felt that something ought to be done to revitalise interest in the recommendations of the report and to draw attention to subsequent developments in the field of safety, health and welfare. The 1953 report had, by this time, gone out of print. There had also been a number of important changes in the law. At first it was thought that a second report should be prepared, but on further reflection it was considered that as the recommendations of the 1953 report, having been cast in sound general terms, were still relevant, it would best serve the interests of the drop forging industry to produce a second or revised edition rather than having two separate reports covering the same ground. In preparing the new report, it is obvious that a great debt is owed to the 1953 Committee. Fortunately, several members of the original Committee still serve on the present body, and have therefore been able to contribute a great deal from their long experience. It is our hope that this publication, together with the advances in legislation, will rekindle interest and lead to positive steps being taken to carry out the recommendations.

4. When the proposal to produce a further report was put to H.M. Chief Inspector of Factories, he agreed, despite all the other urgent calls on their time, to H.M. Inspectors of Factories carrying out, between May and August 1964, a survey of some 180 forges. We are greatly indebted to the Inspectorate for the most valuable fund of up-to-date information thus placed at our disposal.

5. We also wish to acknowledge the technical help so readily made available by the National Association of Drop Forgers and Stampers, both in the preparation of this report and in the revision of Safety, Health and Welfare New Series Booklet No. 12, "Safety at Drop Forging Hammers."

6. An analysis of accidents occurring in drop forges during the years 1954–1964 was prepared for us by H.M. Inspectors of Factories. (Appendix IF.) We have also had available an increasing number of official and other publications dealing with particular aspects of our subject. A list of those available and likely to be of interest to our readers is included in Appendix VIII.

7. There are still some forges in old buildings which have a "gloomy" atmosphere and give one a general impression of an industry in which dirty, dusty and dark conditions are irremediable features. We cannot agree that this state of affairs needs continue, and we believe that our recommendations, if fully implemented, will go far to eradicate the unsatisfactory features which have been for so long characteristic. We consider that there should be no great difficulty in putting our recommendations into effect. In the following paragraphs we comment more specifically on the basis for our recommendations.

Summary of Principal Recommendations

8. The following summary of our recommendations is given:

(a) New forge buildings and the layout of the plant they are to house should be given careful consideration at the planning stage to ensure that the factory, when established, can be run on modern lines with good working conditions and that this high standard can be maintained. (Appendix IA.)

(b) Much can still be done in existing forges to improve working conditions and safety and a properly and systematically planned campaign to improve conditions must result in the betterment of the industry as a whole. We have been unable to lay down specific details of such work but the standards set out for new forges should be taken as the aim of the industry. (Paragraphs 10, 11 and 12.)

(c) A high standard of cleanliness and good industrial housekeeping should be maintained as these play an important part in forge efficiency and in the promotion of healthy and safe working conditions. (Appendix IB.)

(d) Because safety organisation in the forge cannot be limited to the mere observance of statutory requirements, employer and employee should have a clear understanding of the hazards which may arise, of the means to overcome them and of the standard of safety to be maintained as regards the plant in use. We have considered in detail many aspects of safety and danger and in this report make specific recommendations which the industry should carry out. (Appendix IC.)

(e) Welfare facilities (bath and washing accommodation, cloakrooms, canteens etc.) should be reviewed with a view to a general improvement, and in a few cases a very substantial improvement, in the standard of such facilities as are provided at present. (Appendix IE.)

(f) It is fully intended that improvements in forges should result from the adoption of our recommendations. We say this because there are those who read a report and then make the comforting personal reservations that things are not so bad in one's own sphere and nothing much need be done to reach the standards set out. On the contrary we wish the industry to look carefully at our recommendations and to realise that much work is required to be done to fulfil them; we hope that schemes of improvement will be prepared for every forge in the industry.

BUILDINGS

New Forges

9. We have made recommendations for the design of new forges, some quite specific, and others of a general nature. We feel that these standards should be taken as guide lines for the design of new forges but, where there is conflict between such demands as natural lighting, ventilation and noise both internal and external, it is desirable to obtain professional advice.

Existing Forges

10. Since the publication of the 1953 report, there has been a considerable amount of new building and reconstruction but, in a number of cases, the older buildings are still far from satisfactory. Much would be required to bring these buildings up to modern standards. This is not to say it should not be attempted; we believe and recommend that it should.

11. For some unsatisfactory buildings (there is a class of buildings beyond hope) little can be done in the way of reconstruction, but where reconstruction is possible then the standards we have suggested for new forges should be taken as applicable. On the other hand much can be done in existing forges.

12. On the question of ventilation there can be no doubt of the necessity for and possibility of improvement; we have in mind that every effort should be made to continue all furnace chimneys (flues and up-casts) outside the roof structure (some still discharge the products of combustion into the upper air of the forge). Similarly we know of forges where the conditions of draughtiness so affect the workers that they resort to the patching up of openings in the walls by sacks and bags; broken window frames are often left broken and even when repaired are not reglazed. The provision of personal cooling (plenum) ventilation at the hammers for the forges is not wholly satisfactory and we should much prefer to see an extended use of man-cooling fans, placed under the control of the men themselves.

The problem of lighting, particularly artificial lighting, requires urgent attention in some forges and in others there is considerable room for improvement. We wish to emphasize again as we do in Appendix IA dealing with our recommendations that there is no technical reason for the exclusion of light from any forge. We recommend, therefore, that all forges should have windows in the upper structure of the walls. In regard to roof lighting we are aware of the considerable difficulty in keeping this clean and we would, therefore, recommend the increased use of vertical glazing, wherever possible, bearing in mind the associated problem of exterior noise. Artificial lighting, of course, has now been dealt with so thoroughly by the electric lighting industry that there is no need for us to add any new standards. We believe the drop forge industry would benefit from new artificial lighting systems properly designed by experts and maintained and cleaned periodically. Because both light fittings and glazing will normally be at a considerable height, care should be taken to provide the necessary facilities for cleaning and maintaining them.

The floors of some forges are not amenable to proper maintenance and there is no reason, except possibly that of the cost, why this aspect should not have immediate attention. We recommend that employers with problems of this nature should consult the National Association of Drop Forgers and Stampers who are willing to place their information and experience in these matters at the disposal of anyone requiring help.

On the question of maintenance of buildings including lighting, floors and structure, there can be no two minds as to the best economic course—it is to survey the situation at regular intervals and to carry out the necessary work at once. Regular inspection by persons qualified to do this work and specifically appointed to do it is urged upon the industry. Each factory will decide individually upon the frequency of such inspections, but it is urged that proper records of the results of the inspections be kept, including the action taken to remedy the defects found.

Problems of the buildings in the industry cannot be dissociated from the plant which these buildings are to house. It is probably correct to say that the inadequacies of the buildings are frequently due to subsequent changes in plant and layout. We advocate the removal of all surplus machinery to allow the floor space to be opened up and to admit of more spacious appearance. We should advocate a respacing of machinery and plant, but we are all too well aware of the difficulty of such schemes except when reconstructing and rebuilding. We do know of certain forges where this has been done. Replanning, even if carried out only as an exercise on paper, is always valuable, for opportunity arises unexpectedly and might be missed if there had been no preparation. We advise employers who have an idea of resiting to do this on paper. In Appendix IB, we have indicated some ideas of which the Committee are aware and which may be of use to the industry.

Cleanliness

13. We considered this problem under the heading of Cleanliness and Good Industrial Housekeeping and our recommendations in Appendix IB on these aspects are self-explanatory. In Appendix ID we have dealt with handling of materials, and observance of the recommendations we make there can do much to facilitate the maintenance of a high standard of cleanliness.

14. There are quite specific obligations as to cleanliness placed upon the employers by the Factories Act. We set these out in some detail in Appendix VI. We desire to emphasize the importance which should be placed upon these requirements. There is, for instance, a requirement that each day the trade refuse shall be removed from the floors and benches, and a requirement that the floors of the forges shall be cleaned each week. These are parts of the law for which arrangements should be made in each forge so that their observance is somebody's business; someone is in authority to do it or see that it is done. If these requirements were observed in the spirit and letter, there would be much improvement. Then there is the necessity to clean annually, or thereabouts, the walls and ceilings (roofs) of the forges. Perhaps some of the structures are not readily amenable to such cleaning, but the industry should go out of its way to try to make them so.

Safety

15. We have considered in great detail how to obtain full and complete safety in the industry. Examination of the statistics of the accidents which have occurred have led us to consider certain particular types of risk, and we believe that our recommendations, if adopted, will considerably reduce the accident rates.

16. There has been one item of controversy under this heading; that of eye protection. In Appendix IC (Safety) we refer to hot scale as a cause of many eye injuries. Undoubtedly this is true and H.M. Inspectors of Factories, who are members of our Committee, confirm that entries in records kept in ambulance rooms and first-aid rooms in connection with forges show a high incidence of such injuries—many trivial, but always a potential loss of sight. We wish, therefore, to emphasize our anxiety in this matter by quoting from the "Report of the Productivity Team—Drop Forging Industry" under the aegis of the Anglo-American Council on Productivity. Under the paragraph dealing with Safety and Welfare on page 41 at item 3, appears this note:

> "An outstanding feature of the safety precautions was the universal use (in the United States) of goggles. At all the forges visited, everyone, from the President of the Company to the newest employee, was required to wear goggles when entering the works. Even visitors had to comply with the Regulations. Workers were provided with optically corrected goggles and plastic goggles were provided for visitors. Though the climatic conditions at the time of the tour were very trying the team found no objection to the use of goggles. All were conscious that the injuries had been eliminated. The most common accident responsible for lost time in British factories is 'foreign bodies in the eye'. The use of goggles would remove the danger."

We see no reason at all why properly designed eye protection should not be used by all in the industry in this country. There is a reluctance by the workers to wear goggles or other eye protection and it is desirable that all with influence in the industry should make an endeavour to overcome this reluctance. In Appendix IIB, a report is given of experiments in the wearing of eye protection which were carried out at the request of the Committee.

A resolution was sent to H.M. Chief Inspector of Factories in 1962 urging that work at drop hammers should be included in any revised Schedule to the Protection of Eyes Regulations 1938.

17. We would also comment on the value of protective safety boots. Many are now being worn but we consider it a duty of management and operatives alike to use such persuasive propaganda as will ensure one hundred per cent use of this type of footwear.

18. From time to time there occurs in the forge one of those most distressing accidents caused by the protective clothing of a worker being ignited; there is too, considerable likelihood of a forge worker's clothing becoming so soaked with oil and grease that it is readily combustible, and there are so many ready sources of ignition in a forge. It is possible to fire-proof clothing so as to considerably minimize the risk from this cause, and in Appendix IIA we have given some details of a method of doing this.

19. We have recommended the appointment of some person of sufficient status and with sufficient time to allow of efficient work, to supervise the safety organization in each forge. No forge is too small for this to be done and, indeed, it can probably be said that it may be that in certain small forges there is greater need of such an appointment. We do not envisage that the person so appointed will be engaged full time on these duties (except of course in the large units) but this work should be a primary part of his normal duty.

HANDLING OF MATERIALS

20. This subject is not wholly concerned with mechanical handling although mechanical handling will, and does have, a great effect upon planned layout and methods of work. There are, however, certain practices of material handling by slings, tongs and purely manual methods which should be reviewed to see whether the "work" cannot be taken out of the process and also the physical risk that comes with manual handling of materials.

21. There is, of course, an increasing use of mechanical methods of handling materials in this industry as there is in many others. Such methods while having obvious and very real advantages call for a review of shop layout, flow of production etc., in order that mechanical transport, conveyors and other plant can be worked to capacity without jeopardizing the safety and working conditions of employees in the forge.

TRAINING

General

22. Most of the very large firms in the drop forging industry or those who are associated with a group of companies have their own training schools where all levels of craftsmen and technicians are trained under competent supervision. Theoretical training is taken at the local technical colleges under day release schemes and practical training is given in the firm's training school.

Medium-sized firms who have not the facilities for their own schools adopt the same method, using technical colleges for theoretical work and giving practical training within their own workshops under competent foremen or senior technicians.

Future Policy

23. In order to ensure that training within the industry, particularly among the smaller firms, shall be brought to a standard likely to be acceptable to the Engineering Training Board, a scheme is being organized through the Industrial Training Service whereby their training officers will co-ordinate the syllabi, advise on techniques, draw up manuals and organize the procedure. Training will probably be undertaken through group schemes, and it is hoped that by the end of 1965 all firms within the industry who are capable of doing so, will be participating in organized training of a recognized standard.

Training of Foremen and Safety Training

24. The industry has, through its trade association, given special attention to direct training of foremen as being the key men concerned in dealing with junior workers and young entrants. Every year, with one exception, since 1952, four-day or three-day courses on basic supervisory training for foremen in the drop forging industry have been organized in Birmingham or Sheffield with the help of the Industrial Welfare Society and H.M. Inspectors of Factories. These courses are non-technical and have been directed towards instruction in human relations and on foremen's responsibilities for the training of young people and for the safety of all workers on the shop floor. During this 13-year period, some 250 foremen have attended these courses in Birmingham and Sheffield.

In addition, since 1961 four courses have been organized at the Industrial Safety Training Centre, Acocks Green, Birmingham, specially for the Drop Forging Industry; they have to date been attended by a total of 116 foremen and supervisors.

An illustrated brochure was published by the industry in 1957 on "Safety Rules in the Drop Forge," specially designed to appeal to young entrants, and since that date 10,000 copies have been distributed among employees in the production departments. A reprint is being issued early in 1965 and requests have already been received from drop forging companies for 5,000 copies.

First-aid Training

25. Since the year 1960 about 90 first-aid personnel have received training under a group scheme organized specially for the Drop Forging Industry by the St. John Ambulance Association. This facility has been arranged in order to assist drop forging firms to attain the required legal standards of first-aid training.

WELFARE

26. The Factories Act 1961 deals with welfare facilities in considerable detail but we have thought it proper to interpret and improve upon these standards in our recommendations.

27. There are certain matters we discussed in Committee which do not appear in our recommendations; one of these was the use and value of hot-air driers in place of, or in addition to, towels for drying after washing. These appliances are in use in some factories in the industry but we do not consider them wholly suitable for use in an industry where the work is dirty and hot and where there is more than hand drying to be done. There should in our view always be towels available.

28. The problem of washing and bathing after work is often associated with the timing of the public transport connecting with the factory. This is an important aspect of the subject and it should not be beyond the competence of the transport authority and the managements to make suitable arrangements. It is often a case of not more than 15 minutes but this is most important to a worker who may be delayed up to an hour when the special or workers' transport is not arranged to take care of such details. We have considered at length the standard of accommodation desirable for bathing and washing. In our recommendations we have set out a minimum for each, based upon there being proper supervision as to their use and maintenance. This is an important aspect of which sight should never be lost.

29. Competent first aid to deal with accidents, particularly minor and trivial injuries, is most important; it has been proved beyond doubt that by such competent treatment many hours and days of lost time is avoided. All employers should examine with care the first-aid arrangements in their factories.

TECHNICAL DEVELOPMENTS IN THE DROP FORGING INDUSTRY SINCE 1953

Presses and Hammers

30. There has been a significant increase in the use of forging presses instead of drop hammers, with a consequent improvement in working conditions. Because of the high capital investment incurred by the installation of presses, rapid developments in this direction cannot be expected, but present indications are that the trend over the past ten years may continue.

A considerable number of drop hammers driven by overhead shafting have been replaced by self-contained units, with a consequent improvement in safety.

Furnaces

31. The standard of furnace construction has shown a marked improvement, with resulting diminution in pollution of the atmosphere and heat radiation. A very high proportion of furnaces used for heating forging stock is now oil fired and the use of pulverized solid fuel has virtually ceased.

Die Lubricants

32. Use of improved die lubricants has been developed. While it is still necessary to use oil in some instances, the application of colloidal graphite solutions has increased and this has also resulted, in certain instances, in a cleaner atmosphere in the forge.

Compressed Air

33. A serious explosion occurred in the compressed air plant of a West German drop forge in 1963 which resulted in the loss of 20 lives. As soon as information became available on this catastrophe, the National Association of Drop Forgers and Stampers set up a Technical Sub-Committee of experienced engineers to consider safety recommendations which could be made to prevent a similar happening in the British drop forging industry. The report of this Sub-Committee has now been published and its recommendations are reproduced with the permission of the Association as Appendix V.

Evidence has already been found showing that some British drop forgers are insisting that their suppliers of compressed air equipment should comply in every respect with the recommendations now made.

The Use of Liquid Nitrogen for Removing Sole-plates from Power Hammers

34. The sole-plate of a power hammer is held in place by a tapered key which may be as large as 9 ft. long, 8 in. deep and 3 in. thick. Removal of a sticking sole-plate key is often a most difficult task involving the prolonged use of a bumper bar suspended by a chain and wielded by several men. This operation is not only extremely irksome and time consuming, it is also a cause of accidents. Injuries due to falling result when the bumper bar strikes the key a glancing blow, and accidents are also caused by fragments flying from work-hardened keys. Where all efforts to extract the key by this means are unsuccessful, removal by flame cutting has hitherto been considered to be the only alternative. This last resort is of course most undesirable as it involves the replacement of the key at considerable expense.

A method of removing a sticking sole-plate, recently introduced with complete success, involves the use of liquid nitrogen (boiling point: 196°C.) to shrink the sole-plate and its key. After the die has been removed, the sole-plate is cleaned and the ends of the die recess in the sole-plate are sealed with quick-setting clay to form a reservoir for the liquid nitrogen. Similarly, fire clay is used to retain the liquid nitrogen between the anvil and the exposed portion of the key. Liquid nitrogen is then poured in and covered with a sheet of insulating material. As the nitrogen evaporates more is added, and, after a period varying from ½ an hour to 1½ hours, depending on the size of the sole-plate and the temperature of the hammer at the commencement of the operation, the key and sole-plate have contracted sufficiently to be knocked out with ease.

In the forge where this process has been introduced, the liquid nitrogen is delivered in a tanker from which buckets are filled by hose and carried to the hammer. At this stage great care is necessary on the part of personnel carrying out the operation to avoid contact with the liquid. An additional length of hose which would permit the liquid to be delivered directly from the tanker to the hammer would be a means of reducing this hazard. It is appreciated that means of access may not always be sufficient to allow the tanker to be driven close to the hammer and that the liquid will in such cases be carried by hand in containers. As a precaution against contact, therefore, it is recommended that the container be of a non-spill type, and that protective clothing be provided.

Another hazard should be borne in mind. As liquid nitrogen can displace air, the question of oxygen deficiency in the atmosphere should be considered when evaporation of the liquid takes place in or near a confined space.

Automatic Control of Drop Hammers

35. Where a machine has to be operated by more than one man, the danger of an accident caused by misunderstanding is always present. Many accidents arising from this or from lack of co-ordination between the driver and stamper have occurred at drop hammers. A typical accident is that which results when a forging is ejected violently from the hammer due to the driver striking a heavy blow when the stamper is expecting a light one.

Methods of controlling drop hammers, whereby the stamper can both manipulate the workpiece and control the hammer by means of a pedal, have been introduced. Elimination of the need for a driver has reduced the risk of accidents and has enabled the stamper to exercise better control over the forging. The new systems of control enable him to strike heavy or light blows as required, the amplitude of each being readily adjustable to suit the work in hand. The hammer can be made to operate automatically as long as the pedal is depressed, and instantaneous changes from light to heavy blows and vice versa can be made while the hammer is working by altering the position of the pedal.

NEW TECHNIQUES

Cold Forging

36. During the period under review techniques for cold forging have been developed to a considerable extent and these are now in use on a production basis. Such processes include both forward and backward extrusion, and are normally performed on vertical presses. It is perhaps too early to assess the effect that the introduction of these techniques will have on the accident rate, but the absence of heated stock and consequent lack of scale, together with the guarding of such presses, should lead to a diminution in the hazards encountered.

High Energy Rate Forging

37. Plant for high energy rate forging has been developed in the last few years. This is aimed at increasing the rate at which energy is applied to the workpiece in metal forming processes by utilizing the energy of compressed nitrogen.

Use of such machines for normal production is still in the experimental stage and it is not yet possible to assess the extent of their use in the future. The dies in these machines are enclosed to a greater extent than on a drop hammer;

it is probable that this will result in a lower risk of injury from flying scale. On one type of machine, the manufacturers provide complete enclosure by means of an air-operated wire mesh and armoured glass interlocking guard, thus achieving for the first time secure fencing of a hot forging operation.

THE NEED FOR CO-OPERATION

38. The attainment of improved conditions involves not only material expenditure and rearrangement, but also a high development of co-operative spirit among all concerned. While the material expenditure and initiation of organisational arrangements which we recommend are the responsibilities of the employers, it cannot be questioned that the workpeople have an equally important part to play. This is the development of a higher degree of co-operation not only in launching any new arrangements which may be devised, but also a recognition by every individual worker of his personal responsibility. We have been concerned, for instance, with the untidiness of many forges and, while commending the old adage of "a place for everything and everything in its place", it is clear that no amount of provision of proper storage places will achieve any good results unless the workers make effective use of the facilities.

Conclusion

39. We feel that the survey carried out by H.M. Inspectors of Factories shows that there has been a good deal of improvement in the industry over the last ten years, especially in those firms which have made full use of their membership of the Association.

While saying this, we would hasten to add that there is still room for improvement, and in certain regrettable cases need for considerable improvement.

We are particularly disturbed by the alarming increase in the number of reportable accidents, especially over the last two years. The overall pattern has not changed significantly except that there has been a substantial increase in the number of non-machinery accidents. This increase coincides with the special drive by H.M. Inspectors of Factories to secure the reporting of all notifiable accidents, and with a period of sustained high activity and employment in the industry. This perhaps is indicative of an increased state of awareness amongst those concerned and we hope that this Report will give fresh enthusiasm to the willing, rekindle fervour in those who have fallen by the wayside, and prick the consciences of those who have neglected the problems.

(*Signed*) J. A. DAVIS (*Chairman*)
E. J. BEARD
J. C. BEECH
N. T. COOK
J. JARVIE
M. G. KEMP
A. J. POTTER
R. B. H. PURCHASE
A. L. STUART TODD
D. C. THOMAS
M. C. VAUGHAN
P. J. FROST-LOWE (*Secretary*)

APPENDIX IA

Buildings

In considering the best types of buildings for the industry, certain aspects merit special consideration because of their importance in producing efficient and safe working conditions. These include size, design, materials, floors, lighting and ventilation and below are set out the recommendations under each heading. The problems of new and existing buildings differ widely and have, therefore, been considered separately.

NEW BUILDINGS

Size

It must be borne in mind that there are very wide variations in plant layout, types of plant and methods of material handling that could be adopted. It has also been recognized that the best types of modern forge plants do not preclude processes subsequent to the forging operations being carried out in the forging building, e.g. dressing, heat treatment, inspection and despatch. Since the decisions on these matters rest with the user, no attempt can be made to lay down the amount of space required for specified units or working methods. It is considered possible, however, to give guidance as to the approximate minimum standards which should be adopted. For example, where a shop is built to house a single line of drop hammers, a minimum width of 40 ft. should be provided and, where a larger installation is required this width should be increased pro rata. Height should be sufficient to provide good ventilation and in any case should not be less than 20 ft. from floor level to any part of the inside of the roof.

Another factor in considering the size of the building is the need for gangways to be of adequate width to provide safe and comfortable access to all parts of the shop. Where mechanical transport is used they should be of such a width as to enable persons and vehicles to pass in safety. It has been found that a minimum width of 10 ft. of unobstructed gangway provides reasonable access in the principal traffic lanes. The use of three-dimensional models is strongly to be advocated when planning a layout of machinery and means of access and relating these to the size of the building, for it can obviate much subsequent inconvenience and many sources of danger.

Design

The Committee has not thought it within its terms of reference to specify a design which should be adopted for all new forges. Past experience, however, has brought to light certain defects of existing buildings which can be avoided by correct design of new shops.

The buildings should be capable of being closed against the weather without sacrifice of adequate ventilation and natural lighting and be so designed that ventilation and lighting does not depend upon the removal of glazing and sheeting from the structure.

Table 3, Appendix VII, shows that in 15% of the forges surveyed some attempt had been made to provide protection against noise. The Committee is aware that there is at present no proven technical method of reducing noise other than by ear defenders, to which there is great operator resistance.

This does not mean, however, that the problem is being neglected either from the point of view of the persons employed, or, in these days of increasing congestion of population, from the point of view of neighbours of the forge. On the contrary considerable research has already been undertaken by the Drop Forging Research Association, and the trade association is represented on the Noise Panel of the Confederation of British Industries.

Windows should be designed for easy cleaning, and safe and effective means of access to them for this purpose should be considered in the design stage. Vertical glazing is considered to have great advantages over slanting windows, in that it permits easier cleaning and does not accumulate dust and dirt to such an extent.

The advantages to be gained by vertical glazing must be carefully balanced against the increased exterior noise level inevitably caused by its use.

Although its suitability for use in drop forges has not yet been proven by time, the Portal frame construction offers advantages in providing a clear roof space and in the absence of roof bracings which accumulate dirt and impede overhead handling facilities.

Figures 1(a) and 1(b), and 2(a) and 2(b) are diagrams of the design of two new plants which the Committee considers provide a high standard of working conditions.

Materials

The actual choice of materials used must obviously be left to suit the requirements of the individual case, but for walls it is considered that brick, brick panels in a steel frame, or steel sheets in a steel frame are most suitable. The use of combustible or flammable materials in parts of the building adjacent to furnaces or chimneys or where stacks of hot forgings may be a source of ignition should be avoided unless suitable provision is made for insulation.

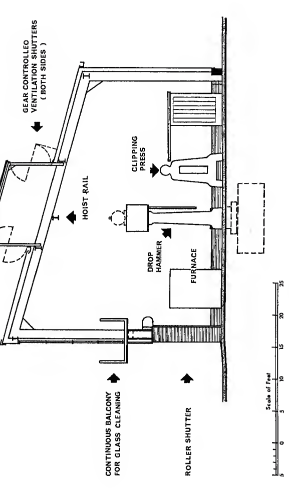
Floors

With the increased use of mechanical handling and the provision of storage bins and racks for forgings, materials and tools, the problem of providing durable and level floors is not so acute. In these circumstances, concrete, properly laid and reinforced, is suitable and has many advantages, being easy to clean and maintain. Where modern working methods are not used, or where hot forgings are allowed to lie on the floor, concrete which is not reinforced at the surface is not capable of withstanding rough usage. In these circumstances, the use of cast iron or steel plates of a non-slip pattern is to be recommended. Blue brick floors have the advantage that, when damaged, bricks can be easily and speedily replaced.

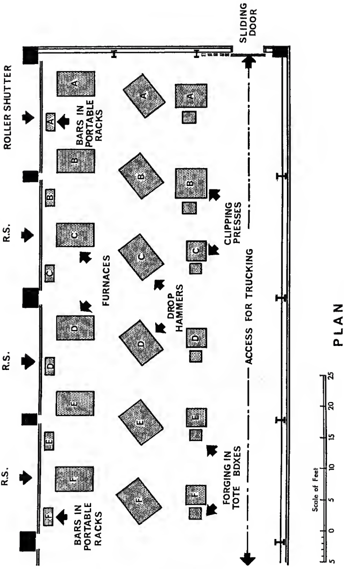
Tables 4 and 4A, Appendix VII, show that 89% of the forges surveyed used various combinations of concrete, brick and steel plate as a flooring with 59% having concrete floors. 11% had a floor, all or some of which was composed of earth. 43% of the floors were above average in their standard of maintenance but 16% were poorly maintained.

Lighting

The traditional darkness in forges arose from the idea that bright lighting prevented the forger from judging correctly the temperature of his forging stock. This fallacy has been responsible for much unnecessary fatigue and many accidents, and is not in keeping with modern conditions and progress. The better the lighting, be it natural or artificial, the less depressing is the atmosphere



CROSS SECTION
FIG. 1a.


SLIDING DOOR
ROLLER SHUTTER
R.S.
R.S.
R.S.
BARS IN PORTABLE RACKS
BARS IN PORTABLE RACKS
FURNACES
DROP HAMMERS
CLIPPING PRESSES
FORGING IN TOTE BOXES
ACCESS FOR TRUCKING
A
A
A
A
B
B
B
B
C
C
C
C
D
D
D
D
E
E
E
E
F
F
F
F
Scale of Feet
5
0
5
10
15
20
25

PLAN

Fig. 1b.

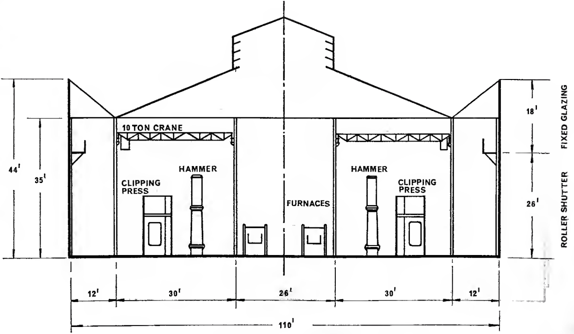


FIG. 2a.—Cross section of typical large heavy forge shop (2 rows of hammers).

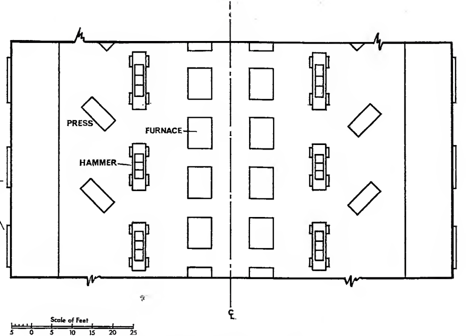


FIG. 2b.—Part plan showing typical plant layout of forge shop (2 rows of hammers).

of the shop and the easier it is to keep clean. Provision should, therefore, be made to ensure that the maximum amount of natural lighting is available.

Artificial lighting should have an even intensity of not less than 15 ft. candles at working level throughout the shop and should be placed high in the roof with some illumination thrown on to the roof to avoid a "tunnel" effect.

A high standard of efficiency of artificial lighting can only be maintained by regular cleaning of the fittings, and access to lighting points should be considered to enable this work to be done safely and effectively.

Table 5, Appendix VII, shows that natural lighting is still poor in 17 % of the forges surveyed and bad in 1 %. The artificial lighting was poor in 13 % of the forges.

Ventilation

The nature of the processes carried on in a drop forge shop results in natural convection currents being set up, and the building should be of such a height as will ensure that the maximum possible advantage is taken of this. Incoming air should enter through openings at the bottom of the walls, the intermediate wall spaces being closed, as openings in these would break the convection current.

Table 6, Appendix VII, shows that general ventilation was average or above in 97 % of the forges surveyed.

Closely allied to the subject of ventilation is that of heating and temperature control. Usually artificial heating in forge shops is neither necessary nor practicable but it may be required if electric furnaces are used. In these circumstances, individual unit heaters have proved satisfactory. The use of man cooling fans to create increased air movement and a pleasanter working atmosphere in high temperatures should be encouraged. Where such fans are installed secure fencing should be provided for the blades.

With regard to furnaces, radiation of heat from the front of the furnace or door should be decreased on open-front forging furnaces by the use of insulated shields, if necessary, or by water jackets, sprays or other equally effective devices. The sides of heating furnaces should be effectively insulated.

Table 3, Appendix VII, shows that 59 % of all forging and heat treatment furnaces were well insulated. Man fans were not provided where they were thought to be necessary in 41 % of the forges surveyed.

Arrangements should be made for the effective removal of all fumes from the forge, preferably by means of hoods and up-cast shafts of adequate size over the furnaces continued to the outside air or by mechanically propelled exhaust fans, with adequate fresh air inlets maintained at all times.

The use of hoods and up-cast shafts takes advantage of the natural thermal up current but some firms have preferred to use under-floor extraction giving uncongested above-equipment space and hence freer access for overhead cranes etc.

Table 6, Appendix VII, shows that local exhaust ventilation was provided in only 31 % of the forges surveyed.

Provision for Erection and Dismantling Heavy Equipment

When new shops are being planned, we recommend that permanent facilities for dismantling and handling plant be incorporated.

Where the installation of overhead cranes is not justified, a runway with chain operated or electrically operated hoist may prove to be adequate. This should be of a capacity sufficient to raise the largest single item of plant to be lifted during maintenance or repairs, for example the guides and overhead gear of hammers. It should be borne in mind that a proper routine maintenance system of drop forge plant is often handicapped by the absence of such provision.

APPENDIX IB

Cleanliness and Good Industrial Housekeeping

GENERAL

The first consideration is a proper approach to the matter by all concerned. All must be convinced of the need for tidiness, that tidiness leads to efficiency and that, to attain a good standard of housekeeping, the co-operation of the workpeople is essential and every encouragement should be given to them. The principles of good industrial housekeeping should be introduced gradually and the following recommendations are made:

The Yard

The yard of the forge is the first place to be tackled. It should always present a tidy appearance. Scrap material, machine parts and forgings etc., should be properly stacked in positions allocated for the purpose and preferably in well defined bays. The entrances and exits should afford free passageway and suitable handling appliances, such as cranes, trucks etc., should be provided to facilitate the movement of materials.

Table 7, Appendix VII, shows that the standard of housekeeping outside the forge was above average in 55% of the forges surveyed and poor in only 6%.

Planning of the Forge and Siting of Machines

In planning the layout of the forge and other shops it is recommended that use should be made of small scale models. Furnaces, hammers and presses should be so situated as to give adequate passageway and to facilitate ease of work and the maintenance and cleanliness of floors. In siting machines it should be borne in mind that they should be so located as to give (a) clearance between machines so that the movement of one operator will not interfere with the work of another and (b) ample room for cleaning machines and handling the work including material and scrap. The arrangement of machines should be such that operators do not have to stand in gangways to work the machinery.

Gangways should be of a width sufficient to permit the free movement of employees bringing and moving material, and the gangway space should be independent of working and storage space and should be clearly defined by markings.

Table 8, Appendix VII, shows that gangways were good in 75% of the forges surveyed but bad in 15%.

Storage of Tools

Adequate facilities for the storage of all tools should be provided in readily accessible positions, which should be made known to all concerned. Workers should be encouraged to report defects and to replace tools not in use.

Care of Plant

The care of plant, machinery and tools is essential to good industrial housekeeping; the higher the standard the better the housekeeping. Debris resulting from the work of maintenance and repair gangs should be removed promptly. Maintenance work should not be regarded as complete until such debris and any equipment used has been removed. Systematic inspection should be made by persons of adequate authority appointed by the management for the purpose of maintaining good industrial housekeeping. Defects or untidiness in the factory should be dealt with immediately; for example repair to a leaking service pipe should not be postponed. Doors, windows and ventilators should be properly constructed and maintained (windows difficult to open are sometimes found broken in the summer and covered with sacks in the winter). Windows should be kept clean.

Piped Services

All piped services should be installed with a view to easy maintenance and the pipes should be painted in distinctive colours. (It is recommended that the British Standard Specification should be followed.) Pipes should be racked or bracketted throughout the factory and if a service is discontinued the pipes should be removed. In the interest of both safety and economy all steam pipes should be suitably lagged. Control valves etc., should be so positioned that they can be easily operated from the floor.

Painting of Machines

All exposed non-working machine surfaces should be painted in light colours, for example green, blue or yellow, with a hard durable gloss paint from which oil and dirt can easily be removed. Repainting should be done periodically.

We have considered how far this can be applied to all forging machinery. We advise no limitation and employers should endeavour to apply this standard to all machinery and plant. We are aware of excellent examples of the effect of painting in this way.

Maintenance of Buildings—Cleanliness

There is an impression that the buildings of the industry are exempt from the requirements of section 1 of the Factories Act 1961. This is not so in general; such exemptions as are applicable concern only small parts of the buildings. We have, therefore, reprinted as Appendix VI this part of the law so that there can be no misunderstanding of the position.

Table 9, Appendix VII, shows that 29% of the forges surveyed did not at the time of the survey comply with the requirements of section 1, Factories Act 1961 to the full extent of their liability, i.e. parts of, or the whole of, the forge had not been whitewashed, painted or otherwise suitably treated within the prescribed period, or the washing or other approved cleaning of the walls etc. had not apparently been carried out within the prescribed period.

Employees' Responsibility

The co-operation of all employed in the works is essential to secure good housekeeping; this would probably best be obtained by the formation of groups with defined spheres of influence covering the whole of the works site. There should be a scheme for ensuring that machine accessories, forgings, tools, etc., are kept in appropriate places, and that such places are available and known.

Employees have legal responsibility in some of these matters, and this aspect should be brought to their notice (section 143 Factories Act 1961 Appendix VI); in this way we can expect maximum co-operation with management to keep clean and in good order the means provided for their well being, and we may mention particularly, first-aid boxes, sanitary accommodation, washing facilities and cloakrooms.

Table 9, Appendix VII, shows that the general standard of cleanliness in the forges surveyed was above average in 36% of the forges and poor in 17%.

Table 7, Appendix VII, shows that the standard of housekeeping inside the forge was above average in 40% of the forges and poor in 15% of the forges.

The impression formed by members of the Committee that standards of cleanliness and housekeeping vary tremendously from forge to forge has been borne out by the survey results, and it has been proved that a reasonable standard can be maintained and that the benefits to all concerned are substantial.

Washing Facilities

Washing facilities, including shower baths and accommodation for clothing, should be separate from, but adjacent to, the production departments, and where practicable there should be full-time attendants in charge of the washing facilities, sanitary accommodation and cloakroom.

Table 10, Appendix VII, shows that 85% of the forges surveyed provided a washbasin or 2 ft. of trough for every 10 persons employed. In the remaining forges the fraction in most cases was not much lower than 1 per 10. The standard of maintenance of washing facilities was below average in only 11% of the forges.

The Committee notes with approval a scheme at one large forge where an employees' committee has complete control of the washing, bathing, toilet and cloakroom facilities. It has drawn up its own rules for the use of these facilities; conducts its own investigations into misuse of the facilities; appoints its own attendant, who is paid a basic wage by the company, which is supplemented by voluntary donations by the men according to the efficiency of the service given, and attends to all other functions except those where a statutory obligation is placed on the occupier.

Table 10, Appendix VII, shows that baths or shower baths were provided at 39% of the forges surveyed. The use made of these facilities varied considerably and depended on whether time was allowed for their use during working hours and, if not, whether public transport timetables catered for the later finish.

Table 11, Appendix VII, shows that in only 75% of the forges surveyed was completely adequate clothing accommodation provided and the clothing accommodation was poorly maintained in more than a third of the forges.

The Canteen

The canteen should, where practicable, be in a building separated from the factory, and it should be designed to ensure that a high standard of cleanliness can be easily maintained. The floor should be hard, smooth and impervious with a slight incline to facilitate flushing with water. The furnishings and fittings should be of non-absorbent materials and easy to clean.

Table 12, Appendix VII, shows that 75% of the forges surveyed provided a messroom and of these only a very small percentage was of a poor standard.

Protective Clothing

It is desirable that employers should arrange a laundry and repair service for the protective clothing.

Posters

Posters and slogans should be used with discretion. The example set by the management, foremen, chargehands and maintenance staff is a good way to secure co-operation in matters of good housekeeping.

APPENDIX IC

Safety

SAFETY SUPERVISION

A competent person should be appointed in writing to exercise supervision with regard to all matters pertaining to the safety of the workpeople and to ensure that the above recommendations are carefully observed. A notice of the name of the person so appointed should be affixed in the works.

Table 13, Appendix VII, shows that 38% of forges surveyed had someone specifically appointed to exercise safety supervision.

Twelve years after the publication of the first report of this Committee, 56% of the forges surveyed were aware of the report. This figure is almost certainly lower than it was at the time of the report's publication. The decline in awareness is almost certainly due to changes in senior management staff over the years, and also the person contacted for the survey may not have been the person responsible for policy decisions in connection with safety, health, and welfare. Some method of periodically reminding factory occupiers of such reports would be very desirable.

The table also shows that, of those that knew of the report, only half had appeared to have made any conscious effort to follow its recommendations and this number represented only 30% of the forges surveyed.

FORGING HAMMERS

Approach to Overhead Shafts Driving Hammers

There is evidence that overhead shafts driving hammers are approached when in motion for the purpose of bearing lubrication etc. When there is such approach suitable arrangements for lubrication should be made which will eliminate the need for approaching the shafting or other machinery. If such arrangements cannot be made then safe means of lubrication should be provided (e.g. long spouted oil cans) and the shafting should be securely fenced.

It is the opinion of this Committee that where oil ring bearings are in use, automatic means of lubrication are neither suitable nor necessary for this type of bearing. These bearings require lubrication only at very infrequent intervals and such lubrication would normally be carried out with the shafting stopped.

Table 14, Appendix VII, shows that compliance with section 13 of the Factories Act 1961 is good. This standard is attained mainly because transmission machinery is not normally approached while in motion and is normally safe by position, and because a great deal of shafting has been eliminated and replaced by transmission machinery which is safe by design.

Overhead Gangways

All overhead gangways should be provided with suitable guard rails to a height at least 3 feet above the gangway and with toe boards to a height of not less than 8 inches. The clear width of a gangway should be at least 18 inches. Access ladders to gangways should preferably be of fixed type (with removable lower sections if such gangways give access to machinery).

Where overhead gangways give access to machinery, such as transmissions, hammer drives or lifter gear, secure fencing should be provided for all parts of machinery. The fencing should be arranged in sections so that in the event of necessary exposure of a part of the machinery while in motion (the conditions under which this may be done being specified in the Factories Act 1961) other adjacent parts of the machinery will remain securely fenced.

Table 14, Appendix VII, shows that approximately one third of the forges surveyed had no overhead platforms. Of those having platforms, more than one third had both guardrails and toeboards but only 4% were without guardrails.

The accident statistics show that approximately 3% of the reportable accidents occurring each year are due to the fall of persons or materials from heights. The practice of using ladders whether secured or not, as a place of work from to perform often strenuous work is still one of the causes of this type of accident.

It is the opinion of the Committee that fixed platforms or tower scaffolds, provided with guardrails and toeboards, should be used wherever practicable.

Unit Drives

Unit drives are advantageous in effecting compliance with the foregoing recommendations, and to this end it is suggested that new installations should be based on the principle of the self-contained unit comprising generally not more than four hammers (two dummy hammers and two finishing hammers).

The self-contained unit now appears to be much more common than at the time of the 1953 report.

Inspection of Hammers

All hammers should be maintained in an effective state of repair. To this end all parts of hammers which may affect the safety of work-people, particularly the connection to the tup, should be inspected daily by a competent person and any necessary repairs carried out before the hammer is again put into operation.

Table 14, Appendix VII, shows that in 18% of the forges surveyed, maintenance of the hammers is still carried out on the "as necessary" principle. The Committee feels strongly that a planned system of inspection and maintenance is essential, not only from the safety standpoint, but also, since the amount of unplanned maintenance is greatly reduced, from the economic standpoint. A form of Service Report used by one organisation is reproduced as Appendix IV. The recommended interval between service inspections of this kind is every six months, unless any item is regularly bad, when shorter intervals should be used.

Overhaul of Hammers

All hammers should be thoroughly cleaned and thoroughly inspected at regular intervals under the supervision of a competent person, and such overhaul as is then found necessary carried out before the plant is again put into use.

Where single shift working is the practice we consider that an interval of five years between such inspections is reasonable, and in the case of double shift working this interval should be reduced to three years.

> Thorough overhaul and cleaning of hammers by a competent person as recommended in the first report appears to be the practice in a very small number of factories, but in those in which it is carried out, the normal period between such overhauls is approximately every three years.
>
> The Committee feels that, while the carrying out of this overhaul and cleaning should not be discouraged, in the light of the very few accidents reported over the last 10 years which can be attributed to the lack of, or would have been prevented by, such an overhaul, it can no longer recommend the carrying out of such an overhaul as a positive aid to safety.

Drop Hammer Dies

The practice of placing cold steel between the dies of drop hammers for the purpose of giving such steel a blow is highly dangerous especially when used to dislodge a stamping stuck in the die. The Committee strongly recommend that this practice should be forbidden except where dies are specially designed to enable this practice to be done in such a manner as will prevent all possibility of the cold steel or pieces therefrom escaping from the dies when a blow is struck.

> The accident reports received by the Committee show that this practice has still not been entirely eradicated. A report of a fatal accident to a man 60 ft. away from the hammer was received by the Committee as late as March 1964. An enamelled notice, which can be affixed to each hammer warning against this practice, can be obtained from the trade association.

Hammer Die Keys

Hammer die keys should be made from a grade of material which, when treated, will not unduly crack or splinter. Such keys should not project excessively between the die or ram so as to endanger the workman and should be frequently dressed.

> The Committee in its revision of Safety, Health and Welfare New Series Booklet No. 12, "Safety at Drop Forging Hammers",* recommended that a material such as EN.9 0·50–0·60 carbon steel normalized should be used for die keys. The booklet also illustrates examples of badly mushroomed keys, examples of which can still be found in use.

Props and Catches

Props and catches of drop hammers should be of sound construction and adequate strength and should be properly maintained; where practicable efficient counter-balanced safety catches should be fitted. Props and catches should be regularly examined and repaired as necessary to ensure freedom from defects. Loose props should be used only when mechanical types of props are impracticable. Particular care should be paid to the conditions of the landing surfaces on the tups and the beds on which the props bear. When dies are being changed or adjusted the tup or ram should be chocked by sufficient props or baulks of timber.

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* Obtainable from H.M. Stationery Office, price 1s. 0d.

Table 15, Appendix VII, shows that half the forges surveyed still use loose wood or metal props for some or all of their hammers and a further 11% are shown as not using props at all at some hammers. The Committee hopes that this figure is due to some misinterpretation of the question in the survey. If it is not it is greatly to be deplored since it is the opinion of the Committee that all hammers should be propped during die changing and all work on the die.

Hammer Treadles

Substantial and effective guards should be provided for all hammer treadles in order to prevent accidental tripping. Such guards should also prevent access from the sides and rear of the treadle.

Table 16, Appendix VII, shows that 45% forges surveyed had no treadle guards as against the 44% where they were guarded or where the hammers were hand-operated.

Tongs

There should be a sufficient supply of tongs in good condition suitable for the work. Tongs are not considered to be suitable for the work unless, at least, (a) they are made to fit the stock; (b) they are proportioned so as to grip the work efficiently; (c) the reins are far enough apart to prevent trapping of fingers if the hammer should strike the jaws.

If the operators are required to make or adjust tongs they should have sufficient training and/or experience to enable them to do this work in a satisfactory manner.

Table 17, Appendix VII, shows that a very high proportion of tongs were suitable for the work and in good condition. However, 1% of accidents occurred because of work slipping from tongs.

Hot Scale

A scale guard of substantial construction should be provided at the back of every hammer, so arranged as to stop all flying objects. This guard may be pivotted to permit easy access to dies, supported on floor standards (Figure 3) or suspended by chains with hooks at the bottom.

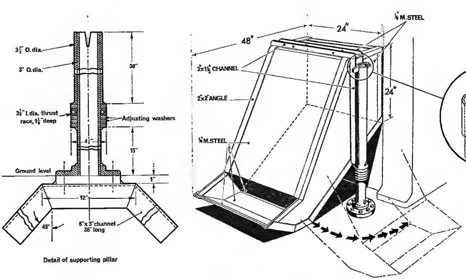
Table 16, Appendix VII, shows that 56% of forges surveyed did not provide scale guards or claimed they were not required.

Effective eye protection should be provided and should be worn by all persons working at, or in the vicinity of hammers or other forging plant from which scale may be projected. An account of experiments in eye protection is given in Appendix IIB.

Table 18, Appendix VII, shows that eye protection is provided in 70% of the forges surveyed and that in 90% of the forges where it is provided, less than 25% of the workers use the eye protection. Of the accidents reported 5½% are in the eye injury category.

Scale Removers

If it is necessary to remove scale by manual methods scale brushes or other similar devices should be provided for this purpose. These should be of such



Detail of supporting pillar

FIG. 3.—Collecting chute and scale guard for rear of drop stamps.

a length as will enable a man to reach the full length of the dies without placing his hand or arm between them.

Lubrication of Dies

Lubrication of dies should be practised to the smallest extent possible and in any event only in accordance with schemes arranged by the management. Where lubrication is authorized, the lubricant should be applied only by a suitable instrument arranged so as to eliminate any need for the hands or arms to be placed between the dies, and should also be of such length as to clear the hammer head or projecting hammer keys. The expression "lubrication" should be taken to include the application of any material deemed to be necessary for the purpose.

Table 16, Appendix VII, shows that, except in a very small percentage of forges, hands were not placed between dies for lubrication or scale removal.

Storage Racks

Storage racks for metal stock, forgings, dies and similar articles should be of adequate strength and stability. Special care should be taken to see that adequate bracing is provided. Metal construction should be used throughout except that shelves may if desired be constructed of sound timber. Racks should be anchored in position.

Materials should be stored in racks in such a manner as to avoid projections which may cause danger.

Approximately 3% of reported accidents were due to material falling over or the collapse of a stack.

OTHER MACHINERY AND PLANT

Presses Used for Cold Clipping, Guards

Secure fencing should be provided and used for the tools on all cold clipping operations.

The secure fencing should consist of:

(a) either a fixed guard which will prevent fingers reaching the trapping area, but so arranged so as to allow the feeding of the work by means of tongs; or an interlocking guard which should conform as a minimum to standards recommended in the Report of the Joint Standing Committee on Safety in the Use of Power Presses dated 1945 and subsequent reports* as issued, (such a guard should, in particular, be arranged so as to prevent fall of the slide in the cases of sliding block clutch presses and of pin-clutch presses at all times when the guard is other than completely closed),

and

(b) fixed guards to prevent access to the danger area from directions not covered by the fixed or interlocking guards referred to in sub-paragraph (a).

OTHER PRESSES USED FOR COLD OPERATIONS SUCH AS SIZING AND COINING

Secure fencing should be provided in accordance with the principles stated in sub-paragraph (a) and (b) above.

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* See Appendix III.

FRICTION SCREW PRESSES

Suitable standards of performance for interlocking guards are contained in the Report of the Committee on Safety in the Use of Power Presses, dated 1945.

HYDRAULIC PRESSES

An interlocking guard should ensure that, except when it is fully closed and preventing access to the danger area, the ram cannot make a closing movement either by pressure or by its own weight, and as long as such closing movement continues the guard cannot be opened.

Presses Used for Hot Clipping

Where presses are in use for hot work which is necessarily held in tongs or other manipulating implements, we consider that the long established practice of working without guards should not be altered; where, however, there is access to the tools through areas not used for handling the work, those areas should be fenced by effective guards to prevent access.

Maintenance of Guards

The importance of careful maintenance of guards cannot be stressed too strongly. In order to secure compliance with the requirements of sections 14 and 16 of the Factories Act 1961, the recommendations made in the Report of the Committee on Safety in the Use of Power Presses should be carried out in detail.

Maintenance of Presses

All presses should be effectively maintained and the mechanisms subjected to thorough examination as recommended in the Report of the Committee on Safety in the Use of Power Presses, 1945.

Since the publication of the first report, regulations (The Power Presses Regulations 1965) have been published laying out statutory requirements for the maintenance of power press guards and presses.

Mechanical Lifting Appliances

All lifting appliances, including their means of suspension and/or anchorage, should be of sound construction, sound material, adequate strength and free from patent defect. They should be thoroughly examined by a competent person once in every period of six months and records kept of the results of such examinations. Any specified repairs should be carried out before the appliance is used again.

Appliances should not be loaded in excess of the safe working load.

It should be noted that sections 26 and 27 of the Factories Act 1961 impose similar requirements regarding the use of chains, ropes and lifting tackle, and cranes and other lifting machines, but certain appliances are not dealt with by sections 26 and 27; this paragraph is intended specially to cover such equipment. All persons concerned with lifting appliances should be properly instructed as to methods of slinging and be given a copy of an appropriate hand-book on this subject.

Approximately 1 % of the accidents reported are the result of defects in lifting appliances or bad slinging.

Erection and Dismantling of Heavy Equipment

In connection with the dismantling and handling of heavy plant, it is imperative that all concerned should understand who is responsible for directing the operation. The person concerned should have a thorough knowledge of the proper use of lifting appliances, and the moving of plant should be adequately planned in advance, for the hasty erection of temporary lifting tackle is a potential cause of serious accidents.

Hot Saws and Billet Saws

All hot saws should be provided with a guard of not less than ⅛th inch sheet metal so positioned as to stop flying sparks and to protect the operator. Suitable means should be provided to trap sparks below the saw. A tank of water placed below the saw is also desirable. All billet saws should have an effective guard capable of being correctly adjusted to the work in hand.

Power Shears

A convenient method of disconnecting the power should be provided for power shears. Shears should not be permitted to run when not in use and crocodile shears should be so located as to face away from passage or aisles.

Hand Tools

All hand tools should be of sound construction, regularly examined and properly maintained.

> Table 17, Appendix VII, showed that the condition of hand tools was average or above in 90% of the forges surveyed. Despite this, 12½% of reported accidents were due to hand tools, which points to the need for more training in the proper use of such tools.

Quenching Tanks

Oil quenching tanks should be protected by a fixed fencing to a height of at least three feet. Effective steps should be taken to maintain the oil at a temperature lower than that at which it will fire spontaneously (e.g. the tank should be sufficiently large and/or adequate cooling arrangements should be made).

Hydraulic Accumulators

Double rail fencing at least three feet high should be provided to prevent access to the area of the accumulator, and the fencing should be so positioned in relation to the accumulator that there cannot be trapping between the top rail and the accumulator. Particular care should be taken to prevent anyone being within the area of the accumulator except when the cylinder is in the bottom position.

Lead Casts

Care should be taken to exclude water from the vicinity of lead casts, and there should be a system to ensure that all ladles and dies used are dry. The operatives engaged on this work should wear suitable eye protection.

GENERAL

Gas and Air Supplies to Furnaces

Furnaces should be provided with individual air blowers arranged as near as possible to the furnaces. Air distribution systems from central sources of supply are considered to be undesirable on the grounds of explosion risk should gas get into the air lines. Gas line installation should be in accordance with the recommendations of the appropriate Gas Acts. Attention is drawn to the recommendations of Safety in Design and Operation of Gas Heated Ovens and Furnaces (Form 1856).*

Floors

The Factories Act 1961, section 28, requires that floors should be of sound construction and be properly maintained. We suggest that smooth metal plates should not be used. In die and machine shops where "duck boards" or similar raised wooden platforms are used on the floor in front of machines they should be substantially constructed and a separate platform should be provided for each machine.

Table 4, Appendix VII, shows that 89% of the forges surveyed used various combinations of concrete, brick and steel plate as a flooring with 60% having concrete floors. 11% had a floor, all or some of which was composed of earth. 43% of the floors were above average in their standard of maintenance but 16% were poorly maintained.

Fire Precautions

An adequate supply of efficient fire extinguishing appliances in suitable positions should be provided. The appliances should be inspected daily and should be renewed or replenished immediately after use. It is expected that the person named under the paragraph dealing with safety supervision will undertake this specific duty but it is realized that another person may be specially appointed.

Fire-proof Clothing

For workers engaged in processes where there is a risk of clothing becoming ignited, protective clothing should be worn and this should include:

(a) For men

Aprons of close woven material, either fire-proofed or of fire-proof material.

(b) For women

Trouser suits or overalls of fire-proofed or fire-proof materials. (For further details of this see Appendix IIA.)

Table 19, Appendix VII, shows that only 23% of forges surveyed provided any form of fire-resistant clothing, e.g. aprons.

Head Protection

Unless some protection in the form of a safety net or similar device is made against hammer crews being struck by falling objects, head protection could with advantage be used.

5% of forges surveyed provided helmets.

Safety Boots and Shoes

Table 20, Appendix VII, shows that 63% of the forges surveyed had a scheme for supplying workers with safety boots or shoes, but in 60% of these, safety boots were worn by less than 25% of the workers.

Eye Protection

Table 18, Appendix VII, shows that eye protection is provided in 70% of the forges surveyed and that in 90% of the forges where it is provided, less than

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* Obtainable from H.M. Stationery Office, price 1s. 9d.

25% of the workers use the eye protection. Of the accidents reported 5½% are in the eye injury category.

Gloves

Table 19, Appendix VII, shows that 77% of the forges surveyed provided gloves or gauntlets.

APPENDIX III

Handling of Materials

The main handling operations in the drop forging industry are as follows:

(a) Unloading and stacking of bars and billets and their transfer from stock to saws, cropping machines and furnaces.

(b) Handling into the furnaces and thence to hammers.

(c) Transfer of forgings from hammers to clipping presses and after clipping, to bins or stillages and thence to inspection, warehouse etc.

(d) Handling in the heat treatment department.

(e) Packing and loading for despatch.

It is noteworthy that considerable advances in handling techniques have been made in the last few years, but critical examination of all handling operations would, in our opinion, reveal that a large amount of unnecessary handling of material is being performed. The elimination of such operations would result in a general increase of efficiency and a reduction of fatigue.

There is no one means by which efficient handling can be achieved, and constant attention by management is necessary. Each forge has its own particular problems and generally different factors are germane.

Manual handling should be replaced by mechanical methods wherever these are practicable, for such methods are generally more economical in manpower and cost, and safer. Where there is no mechanical means of lifting substantial weights, such as die blocks, safety officers or persons in charge should be responsible for instructing operatives in correct working methods and dies should be provided with holes for the insertion of lifting bars.

For many of the handling operations mentioned, fork-lift and other mechanised trucks are now in use. Such trucks can often be operated even in old shops which were not properly designed for them, provided that adequate gangways (as mentioned elsewhere in this report) are maintained.

Many varieties of trucks, mechanical and manual, are obtainable, and in every factory investigation should be made as to the best type for the particular purpose. Constant effort should be made to ensure that forgings are not put directly on to the floor between operations; such a system of working is not in conformity with the best practice and induces unnecessary fatigue among operatives, in addition to the problems which it raises in connection with the maintenance of floors, gangways and adequate working space.

It is often possible to transfer forgings from hammers and from clipping presses to bins by endless conveyors of simple construction; these may be transportable.

When new shops are being planned, handling methods should be decided upon in advance and the building should be so designed as to allow the maximum safe and effective use of mechanical handling devices.

Although safety in the drop forge forms a separate part of this Appendix, it is thought that some reference should be made to safety in connection with the use of mechanical handling equipment. The expanding use of such equipment has brought about new hazards and, although these hazards in no way outweigh the advantages of a modern system of material handling, they should be watched if accidents are to be avoided. For example, in connection with mechanized trucks of all kinds, great care is needed to ensure that the driver is a fully competent person and that no unauthorized person is allowed to drive such a vehicle. All such trucks should be fitted with an audible warning of approach. In the case of fork-lift trucks they should be fitted with overhead protection for the driver. With this type of truck too, care should be taken that it is not driven with the forks inadvertently raised and in such a position as to strike objects overhead. Where mechanical trucks operate in the open, protection for the driver in inclement weather should be provided.

Where conveyor bands are used and access is possible to the nips of the band and drums on the conveyor, fencing should be provided.

Table 21, Appendix VII, shows that 70% of the forges surveyed use fork-lift or other mechanical trucks, 27% use cranes or other lifting appliances. There are, however, 23% of the forges using only rudimentary means of mechanical handling. The majority of these is, of course, in the smaller forges (76% of 0–25 worker range, 31% of 26–50 range) where the high initial capital cost and probably lack of credit facilities are a big obstacle. In the interests of productivity and decreased physical effort, it is felt that some method of overcoming this problem should be devised.

APPENDIX IE

Welfare

SANITARY CONVENIENCES

The conveniences should comply in all respects with the requirements of Statutory Rule and Orders 1938, No. 611 (Appendix VI), and, in addition, there should be at least one wash basin with water laid on in each block of conveniences.

When practicable the conveniences should be in charge of an attendant, and in any case some person should be made responsible for supervision and for maintaining them in a clean and orderly condition. Provision should be made for maintaining a reasonable temperature in the conveniences and toilet paper should be provided.

WASHING ACCOMMODATION

Washing facilities should be provided in a conveniently accessible position, preferably near the main exits of the various departments, and should be maintained in a clean state and in good repair. The facilities should consist of either:

(a) A trough with a smooth impervious surface, fitted with a waste pipe without plug, and of such length or circumference as to allow at least two feet for every ten persons employed and having a constant supply of hot and cold water from the taps or jets above the trough at intervals of not more than two feet.

or

(b) At least one lavatory basin fitted with a waste pipe and plug and having a constant supply of hot and cold water laid on for every 10 persons.

A sufficient supply of clean towels should be provided or, if hot air dryers are installed, there should be at least one dryer for every 10 persons, but it is considered that dryers are not suitable for drying the face.

A sufficient supply of soap preferably from suitable dispensers should be always available at the troughs or basins.

A suitable barrier cream should be provided and used to facilitate removal of grease.

Table 10, Appendix VII, shows that 85% of the forges surveyed provided a wash-basin or two feet of trough for every 10 persons employed. In the remaining forges the fraction in most cases was not much lower than 1 per 10. The standard of maintenance of washing facilities was below average in only 11% of the forges.

The Committee notes with approval a scheme at one large forge where an employees' Committee has complete control of the washing, bathing, toilet and cloakroom facilities. It has drawn up its own rules for the use of these facilities; conducts its own investigations into misuse of the facilities; appoints its own attendant, who is paid a basic wage by the company, which is supplemented by voluntary donations by the men according to the efficiency of the service given, and attends to all other functions except those where a statutory obligation is placed on the occupier.

SHOWER BATHS AND FOOT BATHS

Suitable shower baths should be provided on the basis of a minimum of two showers for every 30 persons, with an additional shower for every 30 persons employed in excess of 30 persons. Hot and cold water should be laid on and a sufficient supply of solid soap and clean towels should be always available. The shower bath cubicles should be suitably screened and a suitable changing cubicle, also screened should be provided for each shower bath. Effective provision should be made for maintaining a reasonable temperature in every room in which the cubicles are installed.

We are impressed by the information we have received that in American forges antiseptic foot baths are always provided. We have not found any example of such provision in this country (even in pit head baths this standard does not seem to be common), but we commend the idea to employers; we think it would be of great advantage to the workers.

Table 10, Appendix VII, shows that baths or shower baths were provided at 39% of the forges surveyed. The use made of these facilities varied considerably and depended on whether time was allowed for their use during working hours and, if not, whether public transport timetables catered for the later finish.

CLOTHING ACCOMMODATION

Suitable cloakroom accommodation should be provided adjacent to the washing accommodation. The cloakroom should be adequately heated and should contain a separate locker for each worker unless there is adequate supervision for such other accommodation as is provided. When practicable the cloakroom and fittings should be in charge of an attendant and in any case some person should be made responsible for supervision and for maintaining them in a clean and orderly condition.

Accommodation near the actual work should also be available for clothing removed in the course of the work.

Table 11, Appendix VII, shows that in only 75% of the forges surveyed was completely adequate clothing accommodation provided, and the clothing accommodation was poorly maintained in a third of the forges.

CANTEEN OR MESSROOM

Where more than 50 persons are employed at any one time, a canteen where hot meals can be purchased should be provided, preferably in a separate building. Where less than 50 persons are employed there should be a messroom or messrooms equipped with adequate means of warming food and boiling water, and such facilities for purchasing light refreshments and hot drinks as may reasonably be required in the circumstances of the case. The canteen or mess-room should be:

(a) Adequately heated and lighted and sufficiently warmed for use at mealtimes.

(b) Provided with sufficient tables and chairs or benches with back rests.

(c) Kept in a clean and orderly condition and preferably in charge of, or supervised by a responsible person.

(d) Separate from any work-room and from the accommodation for clothing.

In every factory there should be means of consultation on canteen matters between management and work-people.

Table 12, Appendix VII, shows that 75% of the forges surveyed provided a messroom and of these only a very small percentage was of a poor standard.

FIRST AID

In every factory in which less than 50 persons are employed first-aid boxes or cupboards should be provided in accordance with the requirements of the First-aid Boxes in Factories Order 1959 (S.I. 1959 No. 906). A notice should be affixed in every workroom stating the name of the person in charge of the first-aid box or cupboard provided in respect of that room.

In every factory in which 50 or more persons are employed a first-aid room should be provided and maintained in good order. The first-aid room should be under the charge of a responsible person trained in first-aid treatment and readily available during working hours.

Arrangements should be made to ensure that for every 50 persons employed at least two persons trained in first-aid treatment are readily available and that all injuries are treated at the first-aid room. Section 61 of the Factories Act 1961 requires at least one person trained to the standard required by The First-aid (Standard of Training) Order 1960 (S.I. 1960 No. 1612).

Table 11, Appendix VII, shows that 70% of the forges surveyed provided a first-aid room. The figure for firms employing more than 100 workers is very nearly 100%.

Supply of Drinking Water and Saline Tablets

We draw attention to the requirements of section 57 Factories Act 1961 (see Appendix VI) which deals with a supply of drinking water; this is of particular importance in forges, and employers should take care that there is adequate observance of this provision.

Suitable saline drinks should be provided, particularly in hot weather. The following drink has been found of value in preventing "cramps" among operatives performing hard muscular work and exposed to high temperatures:

Sodium chloride	6 ozs. (avoirdupois) (180 grammes)
Potassium chloride	4 ozs. (avoirdupois) (120 grammes)
Water	1¾ pints (1 litre)

Note: 17 ozs. of this concentrated solution to be added to three gallons of water for drinking, and a flavouring agent may be added if required to improve the taste. Various saline tablets for manufacturing a suitable drink are also on the market.

Protective Clothing

Recommendations as to protection of eyes and feet and against the danger of ignition of clothing have been made under the relevant paragraphs of the report dealing with Safety. There is, however, certain work where protective clothing should be provided in the interests of the welfare of the person employed, and in this category the following recommendations are made:

(a) Where hot forgings have to be actually handled, asbestos gloves should be provided. In this connection it must be emphasized that the wearing of such gloves does not permit the feeding or removal of work at presses on hot clipping or similar hot operations.

(b) For wet processes, clogs or rubber boots, waterproof aprons and, where necessary rubber gloves should be provided.

(c) For persons employed for long periods in the open air there should be provided:

   (i) In cold weather duffle or similar coats.

   (ii) In wet weather waterproof coats and head gear.

The progressive firm will no doubt be able to elaborate on the recommendations made above and no attempt has been made by this Committee to compile a comprehensive schedule of protective clothing for all the processes associated with the industry.

Note

Where in these recommendations we have suggested a standard of equipment related to a number of persons, this standard should be taken as relating to the largest number of persons employed in the processes at any one time.

APPENDIX IF Analysis of Accidents Reported to H.M. Inspectors of Factories (1954 - 1964)*

		1954		1955		1956		1959		1960		1961		1962		1963		1964	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1. Prime Movers and Transmission																			
(a) Hammers		4	0·5	2	0·3	1	0·1	—	—	—	—	—	—	1	0·1	—	—	1	0·07
(b) Others		—	—	1	0·1	3	0·4	1	1	—	—	—	—	1	0·1	—	—	2	0·14
2. Cranes																			
(a) Mobile...		1	0·13	4	0·6	3	0·4	—	—	—	—	—	—	2	0·25	2	0·21	5	0·36
(b) Permanent		24	3·3	14	0·2	26	3·5	16	2·4	—	—	—	—	15	1·9	14	1·45	12	0·85
3. Power Machinery																			
(a) Drop Hammers		41	5·6	50	7·1	43	5·7	32	4·8	—	—	—	—	29	3·7	47	4·9	56	4·0
(b) Power Hammers		14	2·0	10	1·4	11	1·6	14	2·1	—	—	—	—	10	1·2	13	1·35	7	0·5
(c) Power Presses (Hot)		8	1·2	9	1·2	2	0·2	5	0·7	—	—	—	—	9	1·1	17	1·75	22	1·5
(d) Power Presses (Cold)... ...		10	1·3	5	0·7	5	0·6	4	0·6	—	—	—	—	6	0·75	4	0·4	3	0·22
(e) Other Machinery		76	10·4	47	6·7	56	7·3	46	6·9	—	NOT		—	42	5·3	56	5·8	77	5·5
4. Transport																			
(a) Rail		—	—	—	—	4	0·5	1	0·1		ANALYSED			2	0·25	—	—	—	—
(b) Road and internal works transport		21	2·8	22	3·1	35	4·6	27	0·4	—	—	—	—	31	3·9	33	3·5	46	3·3
5. Fires and Explosions																			
(a) Furnaces		1	0·13	3	0·4	6	0·8	5	0·7	—	—	—	—	6	0·7	3	0·31	3	0·22
(b) Others		2	0·3	3	0·4	4	0·5	4	0·6	—	—	—	—	1	0·1	6	0·62	2	0·14
6. Materials Thrown Out (Hammers Only)																			
(a) Scale or Flash...		25	3·4	42	6	27	3·6	19	3	—	—	—	—	24	3·1	47	4·9	100	7
(b) Others		17	2·4	38	5·4	33	4·4	9	1·3	—	—	—	—	38	4·8	29	3 0	46	3·3
7. Hand Tools	THE BIG FIVE	107	14·3	102	14·5	143	18·5	103	15·5	153	18·2	120	14·4	146	18·4	157	16·8	206	14·5
8. Falls of Persons																			
(a) From Heights		12	1·6	11	1·5	16	2·1	18	2·7	21	2·5	25	3	31	3·9	22	2·3	32	2·4
(b) On Floor ...		43	5·8	40	5·7	30	3·9	29	4·4	61	7·1	66	7·9	52	6·5	74	7·7	94	6·5
9. Falling Materials ...		42	5·7	54	7·7	85	11	91	13·6	117	13·8	115	13·8	105	13·2	122	12·7	239	17·0
10. Handling		235	31·5	196	28	178	23	188	28	174	21	186	22·4	210	26·4	261	27·2	385	27·5
BIG FIVE TOTAL		439	58·9	403	57·4	452	58·5	429	64·2	526	62·6	512	61·5	544	68·4	636	66·7	956	67·9
11. Miscellaneous		50	6·8	50	7·1	60	7·8	55	8·3	—	—	—	—	44	5·5	52	5·4	68	5·0
TOTAL		733	100	703	100	771	100	667	100	847	100	834	100	805	100	959	100	1406	100

* Because of the rounding of figures independently some percentage totals may differ from the sum of the rounded components.

Analysis of Accidents reported

H.M. Inspectors of Factories (1954–1964)

(a) The number of drop forging accidents reported in a year has nearly doubled in the period 1954–1964. The major increase has been in the years 1963–64 when great emphasis and publicity has been given to the requirement to report accidents.

(b) The percentage of accidents due to prime movers, transmission machinery, cranes and other power machinery, with the exception of hot presses, has fallen.

(c) The percentage of accidents due to hot presses, fire or explosion other than at furnaces, falls of persons or materials, and the Big Five as a whole, has risen.

(d) All other categories except those mentioned in (b) and (c) above have stayed fairly stable.

(e) Approximately 80% of hand tool accidents were caused during the use of tongs, sledge hammers, hammers, spanners and crow bars. *The use of spanners accounts for over 25% of hand tool accidents.*

(f) No single cause is responsible for an outstanding increase in accidents due to falling materials.

(g) Approximately 60% of handling accidents were caused while lifting objects, by dropping objects, or by being trapped between the article handled and a fixed object.

(h) Approximately 70% of the eye accidents occurred in the forge and *approximately 50% were due to flying scale or foreign body.*

(i) These figures show that, while the safeguarding of machinery should not be neglected because of both the legal requirements and the greater severity of the accidents, the effort put into reducing accidents under the Big Five heading will pay the greatest dividends in reducing the overall number of accidents and the man hours lost.

Because accidents under this heading are often caused by a wrong choice or an ill-formed judgement by an employee, education of the employees is as important as the provision of the proper tools and equipment.

APPENDIX IIA

Results of an Experiment Carried Out On the Fire-proofing of Clothing

Mention is made in the report and in Appendix IC of the need for fire-proof clothing to be worn by certain forge operators, and below are given details of an experiment which was carried out in a forge on fire-proofing.

Formula used (published by Industrial Welfare Society)

Sodium Phosphate—1 lb. 2½ oz.
Ammonium Phosphate—4 lb. 1 oz.
Ammonium Chloride—3 lb. 6 oz.
Water—5 gallons

The garments were washed, dried and dipped in the solution.

Test No. 1

This test was carried out on jute bags, a form of protection in common use. When dried after proofing the bags were still quite flexible and suitable for use as aprons. A white hot bar held against the frayed edge of the bag produced some smouldering but no fire. Oil was poured on a portion of the bag and a white hot bar applied. The oil caught fire and caused complete destruction of that portion of the bag where oil had been placed.

Test No. 2

This was made on cotton duck aprons already fire-proofed by the manufacturers. A white hot bar placed against the edge of the apron failed to cause burning but the edge was slightly charred. Oil was placed on a portion of the apron and a white hot bar applied. The oil burned but not so freely as on the jute bag, and the fabric, because of a closer weave, was not destroyed to the same extent. After an apron had been in use for seven days it was subjected to the same test and there was no deterioration in the fire-proof qualities. The apron after seven days' use showed no appreciable signs of wear even at the leg position where workers rest bars while carrying them to the hammer. Even when wear at this point did occur the apron could be reversed.

Conclusions

Chemicals to fire-proof as in test No. 1 can be purchased very economically, yet even so, the cost of an apron already fire-proofed, its closely woven fabric, and its wearing propensities make this type of protection a more economical and efficient proposition. Bearing in mind the tests made, it is evident that whatever fire-proof clothing is issued it should be withdrawn from service when oil or grease has become impregnated to such an extent as to cause danger if the clothing is likely to be exposed to a source of ignition.

APPENDIX IIB

Report of Experiments Carried Out On the Wearing of Eye Protection

No. 1

An experiment of one day's duration was carried out in a forge to select the type of eye protection which would be most acceptable to forge workers.

Three groups each of three workers—drop stamp operators, furnace men, and clipping press operators—were issued with eye protection so that each of the nine men had a different form of protection.

At the end of an 8-hour shift during which time the men were observed at work by Committee members, the opinions of the men were sought and, based on these opinions, it was decided that certain types of protection tried were not suitable because of excessive "misting" and/or they made the wearer uncomfortably hot. The men reported favourably on the following types:

Drop stamp operators:	A gauze visor about 9 in. deep on a head band
Furnace men:	Spectacles with tinted safety glass lenses and darker plastic side shields
Clipping press operators:	A clear plastic eye shield with spectacle-type side frames

No. 2

Following this a second experiment was made in another works during mid-April 1953, and eye protection specified as above was issued.

During the whole of one working week, 98 workers in a forge, comprising stampers and mates, furnacemen and clipping press operators, took part in a comprehensive test, and at the end of the period gave their opinions upon the suitability of the protection worn.

During this extended test, the workers rejected the gauze visor and plastic type of eye protection. There was a unanimous opinion expressed by those concerned in favour of the spectacle-type eye protection with side pieces, and the particular types favoured were:

Furnacemen not concerned with protection against flying scale:	Blue tinted safety glass spectacles without side pieces
Hammer men and mates:	Green tinted safety glass spectacles with green plastic side pieces
Clipping press operators:	Clear safety glass spectacles with clear plastic side pieces

The spectacle used was one with a circular lens of approximately two-inch diameter and adjustable side frames and bridge pieces of a robust construction.

The Committee considers that the result of this experiment is sufficiently promising to justify them in expressing the opinion that this type of eye protection is most suitable for use in forges. We should comment that we found the worker quite willing to participate in these experiments, and there seems no reason to doubt his willingness to wear the right sort of eye protection.

APPENDIX III

Maintenance of Power Presses

Reference is made in Appendix IC: Safety, under the heading 'Maintenance of Presses', to the need for press mechanisms and press guards to be subjected to thorough examination and an effective system of maintenance on the lines of that in common use in other industries.

In this connection press users are strongly advised to follow the recommendations of the published reports of Joint Standing Committees on the use of power and hydraulic presses, the titles of which are as follows:

Report of the Committee on Safety in the Use of Power Presses, 1945.

First Report of Proceedings of the Joint Standing Committee on Safety in the Use of Power Presses, 1950.

Report of the Joint Standing Committee on Safety in the Use of Power Presses—Fencing of Hydraulic Presses, 1952.

Third Report of Proceedings of the Joint Standing Committee on Safety in the Use of Power Presses, 1957.

Fourth Report of Proceedings of the Joint Standing Committee on Safety in the Use of Power Presses, 1959.

Power Press Safety Code—Fifth Report of Proceedings of the Joint Standing Committee on Safety in the Use of Power Presses, 1965.

Statutory requirements are given in the Power Presses Regulations 1965.

APPENDIX IV

HAMMER NO. SERVICE REPORT

SIZE..........DATE OF MANUFACTURE..........DATE OF INSPECTION..........

BOLT TIGHTNESS	TIGHT	SLACK	NOTES
1. Lifter Shaft. Brg. Bolts			
2. Lifter Shaft. Brg. Cap Bolts			
3. High Speed Shaft. Brg. Bolts			
4. High Speed Shaft. Brg. Cap Bolts			
5. Buffer Bolts, Tup			
6. Buffer Bolts, L. Arm			
7. Top Tie Boots			
8. Hold Up Brkt. Bolts			
9. Lifter Structure Bolts			
10. Standard to Block Bolts			
11. Headgear to Standard Bolts			
12. Platform Bolts			
13. Ladder Bolts			
14. Auto Gear Support Bolts			
15. Slide Bolts			

WEAR AND GENERAL CONDITION	SATIS-FACTORY	WORN	ADJUSTMENT	
			GOOD	BAD
16. Friction Drum				
17. Friction Band				
18. Hold Up Band				
19. Hold Up Gear				
20. Gearwheel				
21. Pinion				
22. Bearings H.S.				
23. Bearings Oil Lids				
24. Bearings Liftershaft				
25. Bearings Oil Lids				
26. Auto Gear-Aeromatic/Simplex				
27. Gut				
28. Chain				
29. Slides				
30. Tup—Vees				
31. Tup—Dovetail				
32. Anvil Block Surface				
33. Anvil Block Dovetail				
34. Lifter Belt and Slings				
35. Vee Ropes				

GENERAL	SATIS-FACTORY	CLEAN	LOOSE	DIRTY
36. Headgear Structure				
37. Motor				

PERFORMANCE: AT WORK/NOT WORKING

REMARKS: ....

....

Inspected by..

APPENDIX V

Safety Recommendations for Compressed Air Systems

PRINCIPAL FACTORS CONTRIBUTING TO FIRE AND EXPLOSION HAZARDS

The principal factors contributing to fire and explosion hazards in compressed air systems are given below, but the order in which they are listed does not indicate their relative importance.

Inefficient Air Filtration
"Carry Over" of Lubricating Oil
Excessive Temperature of Air at Outlet of Compressor
Failure of Cooling Water System
Deposits of Solids in Airlines and Receivers
Use of Incorrect Lubricating Oil
Lack of Inspection and Maintenance
Simultaneous Closing Down of Air-operated Plant
Bad Design of Installation
Air Heaters either Defective or of Incorrect Type
Failure of Compressor Lubricating System

RECOMMENDED PRECAUTIONS

Precautions recommended in the use of compressed air systems are set out in relation to the factors contributing to fire and explosion hazards as shown above. In addition, brief reference is made to fire-fighting equipment and a summary is presented of suitable warning systems and protective devices.

1. *Inefficient Air Filtration*

1.1. In a new installation, special consideration should be given to the installation of compressors and equipment on a site with maximum atmospheric cleanliness.

1.2. Siting of air intakes should be such that air entering the compressing plant is as dry, cool and clean as practicable.

1.3. Compressors should be installed with an inlet air filter system designed and constructed in such a manner that the whole of the air entering the compressor shall pass through the filter system. Filters should be of adequate capacity and of an efficiency not less than grade 'A'—B.S. 1701: 1950.

1.4. Filters should be accessible for cleaning and maintenance without the aid of special tools and without disturbing other portions of the installation. Filters should be thoroughly cleaned or replaced by clean units at regular intervals not exceeding one month. The use of paraffin or similar flammable material for cleaning filters is strongly condemned. Instead, the use of steam cleaning or a non-flammable liquid degreasing agent is recommended.

1.5. Where either a viscous (oil wetted) or oil bath type of filter is used, only oils having a flash point not lower than that of the oil for lubricating the compressor should be employed.

1.6. Ducting between air inlet and filter should be as short as possible.

1.7. For information on filters for air supply, in respect of scope, construction, test performance and recommendations for installation and servicing, reference should be made to B.S. 1701: 1950.

2. *"Carry Over" of Lubricating Oil*

2.1. The practice of plant lubrication by deliberate "carry over" is not recommended; plant lubrication should be effected by local injection of lubricant.

2.2. There is a very definite hazard from oil vapour carried over at high temperature unless an after-cooler is used. Oil-lubricated compressors should, therefore, be fitted with an after-cooler as close to the compressor discharge as possible; an efficient oil and moisture separator is a further safeguard. Where an oil-less compressor is employed, after-cooling is not essential to the safe running of the system.

2.3. Attention should be given to proper lubrication of the cylinder walls of the compressor. For this purpose, forced lubrication, with which it is possible to obtain accurate regulation of oil flow, is preferred for medium and large compressors.

2.4. The prolonged "off load" running (or idling) of a compressor should be avoided, as a danger exists from possible accumulation of cylinder lubricating oil due to the lack of airflow to disperse it. This applies particularly to a multi-unit installation where excessive idling of a unit could be unobserved.

3. *Excessive Temperature of Air at Outlet of Compressor*

3.1. Air temperature at outlet of multi-stage compressors should not exceed 160°C. (320°F.).

3.2. A temperature indicator and/or recorder should be fitted at the compressor discharge and a careful watch kept on the cooling water outlet temperature. Temperature indicators should be kept in good repair and "shift" records maintained. At the first sign of unusually high operating temperatures, prompt action should be taken to restore normal conditions.

3.3. An effective protective device against abnormal rise of air temperature should be fitted close to the outlet of the discharge valve or valves at each cylinder. The best arrangement is for the compressor to be stopped automatically on operation of a thermostatic control. Provision should, in any case, be included for an audible warning.

3.4. Obstruction of the intake, e.g. by throttling of the suction or by a choked air cleaner, should be avoided as this depresses the intake pressure and, therefore, increases the compression ratio leading to overheating.

3.5. Excessive increase in back pressure at the compressor through obstruction at the delivery, e.g. by use of too small a delivery pipe, should be avoided.

3.6. The automatic "cut-out" on the compressor and the relief valve on the receiver should be maintained in good working order.

3.7. Partial recompression of air should be avoided by immediate replacement of faulty discharge valves and worn piston rings. Excessive cylinder wear must be corrected.

3.8. Fusible plugs are of debatable value, but if used should be renewed annually.

4. *Failure of Cooling Water System*

4.1. Adequate water cooling should be provided. Correct circulation of cooling water should be checked by means of visible outlet or flow indicators and by comparing inlet and outlet water temperatures, the outlet being not more than 8–11°C (14–20°F) above the inlet temperature.

4.2. In hard water areas a means of partial softening or other chemical treatment of compressor "make up" cooling water before use is recommended, thus minimizing scale deposition in cylinder or after-cooler water jackets.

5. *Deposits of Solids in Airlines and Receivers*

5.1. Deposits of solids in airlines and receivers are primarily caused by surface corrosion and by oxidation of oil and impurities in the line due to inadequate filtration. Access at convenient points should be provided for inspection of airlines. Receivers, airlines, inter-coolers, after-coolers and the main supply pipes should be blown out at least once daily.

5.2. Spontaneous combustion of solid deposits can be a prime cause of fire or explosion in airlines. Sections of airlines adjacent to the compressor should be cleaned at least once annually or at more frequent intervals if the build up of deposits indicates that this is necessary.

5.3. Welding repairs should not be carried out on airlines unless they have been cleaned previously, as fires have occurred through neglect of this precaution.

6. *Use of Incorrect Lubricating Oil*

6.1. It is important to adhere to the manufacturers' recommendations for approved grades of lubricating oil in order to avoid the formation of excessive deposits in the cylinders, valves and pipelines which could increase the risk of a fire occurring in the mains.

6.2. The risk of fire is not minimized by using an oil of extremely high flash point. The oil used should have a high chemical stability, should not break down under pressure, should have low carbon-forming tendencies and mild inherent dispersing properties. The appropriate grade for cylinder lubrication is normally in the range 80–140 C.S. at 100°F. (equivalent to 325–567 Redwood No. 1); oils of about 95 C.S. at 100°F. (equivalent to 383 Redwood No. 1) being widely preferred. For compressors running at high operating temperatures the manufacturer should be consulted.

6.3. The feed rate of cylinder oil supply should be adjusted to the minimum rate giving effective lubrication and is best determined by experience with the compressor concerned or by comparison with identical compressors. There should be no accumulation of oil in discharge passages or on the pistons of reciprocating compressors.

6.4. A fire hazard will exist if the discharge temperature of the air exceeds the flash point of the oil at the discharge pressure, particularly when the air flow is reduced to a very low rate. While under normal circumstances the amount of oil carried over in the air will fall far short of that necessary at the lower limit of flammability even when the compressor is unloaded, nevertheless, in the avoidance of an explosion the critical factor is the prevention of a source of ignition either from abnormally high air temperatures or from chemical reactions.

7. *Lack of Inspection and Maintenance*

7.1. Existing installations should be checked to ensure that adequate inspection and access points are provided.

7.2.1. New mains should be constructed with suitable isolating valves to facilitate dismantling or should be jointed in convenient lengths for cleaning, particularly in those sections nearest the compressor or the receiver.

7.2.2. Where a shut-off valve is installed in the discharge pipe between a compressor and after-cooler or receiver, a relief valve of sufficient capacity to take the entire output of the compressor must be placed in the pipeline between the compressor and the shut-off valve.

7.3. Records should be kept of the inspection, cleaning or draining of air filters, valve chambers, inlet and discharge valves, unloaders, inter-coolers and after-coolers, connection points, air receivers, drain points, outlets from air receivers, header mains, oil separators and ring mains.

7.4. Volatile solvents such as gasolene, paraffin or white spirit should on no account be used for cleaning either the internal surfaces of the air system or the filter elements. Instead, the use of steam cleaning or a non-flammable agent is recommended.

7.5. Flexible pipes and jointing should be inspected regularly for leakage and replaced or repaired promptly, they should not be made from flammable material.

8. *Simultaneous Closing Down of Air-operated Plant*

8.1. The simultaneous closing down of air-operated plant should be avoided. If conditions already exist in the air system which are capable of giving rise to an explosion, such action could aggravate the danger by preventing the flow of cooling air.

9. *Bad Design of Installation*

9.1. Delivery mains should be carried overhead wherever possible.

9.2. Supports and brackets should be adequate; inspection should be made periodically to ensure that sagging has not occurred.

9.3. Drain points and automatic discharge valves should be provided at frequent intervals and pipelines leading to them should slope downwards in the direction of the air flow.

9.4. Pipe diameters between the compressor and receiver should be of ample proportions in order to avoid overheating.

9.5. Take-off points should be designed so that they do not form a trap, and should be sited preferably at the top of the pipe.

9.6. Sharp corners and sudden changes of section should be avoided, but where they exist, drain points should be fitted.

10. *Air Heaters either Defective or of Incorrect Type*

10.1. Air heaters in which either a flame or hot gases are in direct communication with the compressed air current are condemned as a potential source of danger.

10.2. Air heaters using the heat-exchanger principle should be installed with automatic temperature control, and adequate maintenance should be given so as to avoid the possibility of hot gases leaking into the compressed air current and to avoid build up of deposits in the tubes.

11. *Failure of Compressor Lubricating System*

11.1. In certain compressors, e.g. those rotary compressors where the crank-case lubricant is employed as a cylinder lubricant and is consequently in contact with the air under compression, special attention must be given to the quality, temperature, cleanliness and avoidance of excessive consumption of oil, as lack of attention to these points can lead to dangerous conditions.

12. *Fire-Fighting Equipment*

12.1. Piped water for a fire hose or a sufficient number of portable extinguishers of a suitable type should be kept in a convenient place on the intake side of the system.

13. *Summary of Warning Systems and Protective Devices*

The following recommendations are given for types of unit and position:

13.1. PRESSURE/VACUUM GAUGES

13.1.1. Between inlet air filter and compressor.

13.1.2. At the air compressor after each stage of compression.

13.1.3. On the air receiver.

13.1.4. At the outlet of the air heater, if fitted.

13.2. THERMOMETERS

13.2.1. At the outlet of each stage of the compressor.

13.2.2. At the outlet from the after-cooler.

13.2.3. At the outlet from the air heater, if fitted.

13.3. Thermal protective devices should be fitted at the outlet of the compressor and at the outlet of the air heater, if fitted. The "set" point at the outlet of the compressor should not exceed 160°C (320°F).

13.4. The cooling water circuit outlets should be fitted with a suitable protective device which will operate either when the water temperature exceeds 71°C (160°F) or when the water-flow rate falls below a predetermined figure set by the compressor manufacturer.

13.5. Temperature recorders and thermometers should be of a type that will respond readily to any rise in temperature.

13.6. Operation of any one of the protective devices should sound an identifiable alarm and should, where practicable, automatically and immediately stop the compressor.

13.7. Gauges and protective devices must be kept in working order.

APPENDIX VI

Certain Requirements of Factories Act 1961

FACTORIES ACT—SECTION 1

Cleanliness

1. (1) Every factory shall be kept in a clean state and free from effluvia arising from any drain, sanitary convenience or nuisance.

(2) Without prejudice to the generality of subsection (1) of this section,

(*a*) accumulations of dirt and refuse shall be removed daily by a suitable method from the floors and benches of workrooms, and from the staircases and passages;

(*b*) the floor of every workroom shall be cleaned at least once every week by washing or, if it is effective and suitable, by sweeping or other method.

(3) Without prejudice to the generality of subsection (1) of this section but subject to subsection (4) thereof, the following provisions shall apply as respects all inside walls and partitions and all ceilings or tops of rooms, and all walls, sides and tops of passages and staircases, that is to say,

(*a*) where they have a smooth impervious surface, they shall at least once in every period of fourteen months be washed with hot water and soap or other suitable detergent or cleaned by such other method as may be approved by the inspector for the district;

(*b*) where they are kept painted in a prescribed manner or varnished, they shall be repainted in a prescribed manner or revarnished at such intervals of not more than seven years as may be prescribed, and shall at least once in every period of fourteen months be washed with hot water and soap or other suitable detergent or cleaned by such other method as may be approved by the inspector for the district;

(*c*) in any other case they shall be kept whitewashed or colourwashed and the whitewashing or colourwashing shall be repeated at least once in every period of fourteen months.

(4) Except in a case where the inspector for the district otherwise requires, the provisions of subsection (3) of this section shall not apply to any factory where mechanical power is not used and less than 10 persons are employed.

(5) Where it appears to the Minister that in any class or description of factory or parts thereof any of the foregoing provisions of this section are not required for the purpose of keeping the factory in a clean state, or are by reason of special circumstances inappropriate or inadequate for that purpose, he may, if he thinks fit, by order direct that those provisions shall not apply to factories, or parts of factories, of that class or description, or shall apply as varied by the order.

THE FACTORIES (CLEANLINESS OF WALLS AND CEILINGS) ORDER 1960

(S.I. 1960 No. 1794)

The Minister of Labour by virtue of the powers conferred on him by section 1 of the Factories Act 1937, as amended by section 1 of the Factories Act 1959, and of all other powers enabling him in that behalf, hereby makes the following Order:

Citation, commencement and revocation

1. (1) This Order may be cited as the Factories (Cleanliness of Walls and Ceilings) Order 1960, and shall come into operation on the first day of January 1961.

(2) The Factories (Cleanliness of Walls and Ceilings) Order 1938, the Factories (Cleanliness of Walls and Ceilings) (Amendment) Order 1948, and the Factories (Cleanliness of Walls and Ceilings) Order 1958, are hereby revoked.

Interpretation

2. (1) The Interpretation Act 1889, shall apply to the interpretation of this Order as it applies to the interpretation of an Act of Parliament, and as if this Order and the Orders hereby revoked were Acts of Parliament.

(2) In this Order—

"the principal Act" means the Factories Act 1937, as amended by or under any other Act;

"to wash" means to wash with hot water and soap or other suitable detergent or to clean by such other method as may be approved by the inspector for the district; and

"walls and ceilings" means all inside walls and partitions, and all ceilings or tops of rooms, and all walls, sides and tops of passages and staircases.

Manner of painting and repainting

3. For the purposes of sub-paragraph (ii) of paragraph (*c*) of section one of the principal Act, the manner of painting, and of repainting, walls and ceilings shall be the application of a suitable paint in such a manner as to produce over the whole of the treated surface a compact continuous film capable of being washed with hot water and soap or other suitable detergent or of being cleaned by such other method as may be approved by the inspector for the district.

Intervals for repainting and revarnishing

4. For the purposes of the said sub-paragraph (ii)—

(*a*) walls and ceilings which are kept painted in a prescribed manner shall be repainted in a prescribed manner at intervals not exceeding seven years, and

(*b*) walls and ceilings which are kept varnished shall be revarnished at intervals not exceeding seven years;

so, however, that (without prejudice to the preceding requirements of this Article) the whole or part of the surface shall be repainted or, as the case may be, revarnished as often as may be necessary to maintain over the whole surface a compact continuous film of the kind referred to in Article three of this Order.

Exempted premises

5. Subject to Article six of this Order, paragraph (*c*) of section one of the principal Act (which provides for the periodical washing, painting or varnishing, or whitewashing or colourwashing, of walls and ceilings) shall not apply to the factories or parts of factories specified in the Schedule to this Order:

Provided that the said paragraph (*c*) shall continue to apply to engine-houses, maintenance shops, messrooms, cloakrooms, lavatories and sanitary conveniences.

Cleanliness of exempted premises

6. (1) If it appears to the inspector for the district that any part of a factory to which, by virtue of Article five of this Order, paragraph (*c*) of section one of the principal Act does not apply is not being kept in a clean state, he

may by written notice require the occupier to whitewash or colourwash, or to wash, or to paint in a prescribed manner or varnish, that part. In the event of the occupier failing to comply with any such requisition within two months from the date of the notice Article five of this Order shall cease to apply to the part of the factory to which the notice relates unless and until the inspector for the district otherwise determines.

(2) The reference in this Article to the inspector for the district shall, in the case of any factory as respects which the provisions of paragraph (*c*) of section one of the principal Act are enforceable by a district council, be construed as a reference to the medical officer of health of that council.

Schedule

(*Exempted premises referred to in Article five of this Order*)

1. Blast furnaces, melting shops and rolling mills and sintering, crushing and screening houses in connection with any of the foregoing.
2. Electric generating or transforming stations.
3. Saw mills including re-saw mills.
4. Brick and tile work in which unglazed bricks or tiles are made.
5. Control rooms and pump houses being rooms and houses in chemical works, in tar distillation work, in gas works or used in connection with coke ovens.
6. Retort houses of gas works and purifier houses of gas works.
7. Platers' sheds, prefabrication sheds and blacksmiths', coppersmiths', anglesmiths' and plumbers' shops being sheds and shops in shipbuilding yards.
8. Ceilings or tops of rooms in print works, bleach works or dye works being rooms in which steam is evolved in the process.
9. The following parts of factories, that is to say—

   (*a*) parts in which lamp black, carbon black, charcoal or graphite is manufactured or is used to a substantial extent in the form of powder for any process;

   (*b*) parts in which lime, limestone or chalk is crushed or ground;

   (*c*) parts used for storage and in which no process is regularly carried on;

   (*d*) parts of rooms, passages and staircases which are at least twenty feet above the floor or stair; and

   (*e*) parts of cement works in which dry materials are handled or manufactured.

THE SANITARY ACCOMMODATION REGULATIONS 1938

(S.R. AND O. 1938 No. 611)

In pursuance of section 7 of the Factories Act 1937, and of all other powers enabling me in that behalf I hereby make the following Regulations:

1. These Regulations shall apply to all factories as defined in section 151 of the said Act and to electrical stations to which subsection (1) of section 103 of the Act applies.
2. In cases where females are employed there shall be at least one suitable sanitary convenience for every 25 females.

3. In cases where males are employed there shall be at least one suitable sanitary convenience (not being a convenience suitable merely as a urinal) for every 25 males:

   Provided that in the case of factories where the number of males employed exceeds 100 and sufficient urinal accommodation is also provided, it shall be sufficient if there is one such convenience as aforesaid for every 25 males up to the first 100, and one for every 40 thereafter.

   Provided further that in the case of a factory where the number of males employed exceeds 500, not being a factory constructed, enlarged or converted for use as a factory after the 30th June, 1938, it shall be sufficient to provide one such convenience as aforesaid for every 60 males if sufficient urinal accommodation is also provided and if the Medical Officer of Health issues a certificate (which shall be kept attached to the general register so long as it remains in force) that in his opinion the arrangements at the factory are such that this proviso may properly be applied to the factory. Any such certificate shall be liable at any time to be revoked by the Medical Officer of Health by notice in writing.

4. In calculating the number of conveniences required by these Regulations, any odd number of persons less than 25, or 40, as the case may be, shall be reckoned as 25 or 40.

5. Every sanitary convenience shall be sufficiently ventilated, and shall not communicate with any workroom except through the open air or through an intervening ventilated space:

   Provided that in the case of workrooms in use prior to 1st January, 1903, and mechanically ventilated in such manner that air cannot be drawn into the workroom through the sanitary convenience, an intervening ventilated space shall not be required.

6. Every sanitary convenience (other than a convenience suitable merely as a urinal) shall be under cover and so partitioned off as to secure privacy, and shall have a proper door and fastenings. Urinals shall be so placed or so screened as not to be visible from other parts of the factory where persons work or pass.

7. The sanitary conveniences shall be so arranged as to be conveniently accessible to the persons employed at all times while they are at the factory.

8. In cases where persons of both sexes are employed, the sanitary conveniences for each sex shall be so placed or so screened that the interior shall not be visible, even when the door of any convenience is open, from any place where persons of the other sex have to work or pass; and, if the conveniences for one sex adjoin those for the other sex, the approaches shall be separate. The conveniences for each sex shall be indicated by a suitable notice.

9. These Regulations may be cited as the Sanitary Accommodation Regulations 1938, and shall come into force on the 1st July, 1938, and shall be without prejudice to the requirements in subsection (1) of section 7 of the Act that the conveniences shall be maintained and kept clean and that effective provision shall be made for lighting the conveniences.

10. As from the 1st July, 1938, the Sanitary Accommodation Order of 4th February, 1903, is hereby revoked.

FACTORIES ACT 1961—SECTION 143

Duties of Persons Employed

143.—(1) No person employed in a factory or in any other place to which any provisions of this Act apply shall wilfully interfere with or misuse any means, appliance, convenience or other thing provided in pursuance of this Act for securing the health, safety or welfare of the persons employed in the factory or place, and where any means or appliance for securing health or safety is provided for the use of any such person under this Act, he shall use the means or appliance.

(2) No person employed in a factory or in any other place to which any provisions of this Act apply shall wilfully and without reasonable cause do anything likely to endanger himself or others.

FACTORIES ACT 1961—SECTION 57

Supply of Drinking Water

57.—(1) There shall be provided and maintained at suitable points conveniently accessible to all persons employed an adequate supply of wholesome drinking water from a public main or from some other source approved in writing by the district council.

(2) A supply of drinking water which is not laid on shall be contained in suitable vessels, and shall be renewed at least daily, and all practicable steps shall be taken to preserve the water and vessels from contamination; and a drinking water supply (whether laid on or not) shall, in such cases as the inspector for the district may direct, be clearly marked "Drinking Water".

(3) Except where the water is delivered in an upward jet from which employed persons can conveniently drink, one or more suitable cups or drinking vessels shall be provided at each point of supply with facilities for rinsing them in drinking water.

(4) The approval required under subsection (1) of this section shall not be withheld except on the ground that the water is not wholesome.

APPENDIX VII

Survey Results

A survey of 180 drop forges was made by H.M. Inspector of Factories and it was found that 112 of these were forges belonging to companies who were concerned wholly or very substantially with drop forging. The criterion applied in deciding this was that more than 50%, or more than 150 employees, worked in, or were directly connected with, the forge. Of this 112, 82 forges belonged to companies who are members of the National Association of Drop Forgers and Stampers. The remaining 68 forges were attached to companies where drop forging constituted a minor part of their activities, and as such come outside the bounds of what would normally be considered as "The Drop Forging Industry".

All the results have been expressed as percentages, except in Tables 1 and 2, so that direct comparisons can be made between groups of various sizes.

Although figures are given to one place of decimals this should in no way be taken as a degree of accuracy and in the interpretation of these figures the following considerations should be borne in mind:

(a) Although the survey questions were framed as far as possible to eliminate subjective decisions, inevitably many remained.

(b) The survey was carried out by a number of Inspectors, so that absolute uniformity of interpretation and decision cannot be guaranteed.

(c) There is no indication from the survey as to the level of management contacted during the survey of individual forges.

(d) There was undoubtedly a bias towards a satisfactory marking in those cases which were marginally poor or marginally good.

A = Exceptionally high
B = Good
C = Satisfactory
D = Poor
E = Exceptionally low

Table 1 Numbers employed in Factory compared with numbers employed in Forges

No. in Factory	Number Employed in Forge										Total
	0–10	11–20	21–30	31–40	41–50	51–75	76–100	101–125	126–150	151+	
0– 25 ...	18	9	—	—	—	—	—	—	—	—	27
26– 50 ...	4	10	3	2	—	—	—	—	—	—	19
51–100 ...	3	10	7	4	4	4	2	—	—	—	34
101–150 ...	3	4	3	2	1	3	—	2	1	—	19
151–200 ...	1	1	1	1	1	4	3	—	1	—	13
201–300 ...	1	1	1	1	2	—	3	2	—	2	13
301–400 ...	1	2	1	1	1	1	1	—	—	3	11
401–500 ...	2	1	1	—	—	2	—	—	—	2	8
501–600 ...	2	1	2	—	2	—	—	—	1	4	12
1001+ ...	3	3	4	2	3	1	2	—	2	4	24
Total ...	38	42	23	13	14	15	11	4	5	15	180

Table 2 Distribution of Hammers as aoainst numbers employed in Factory

No. Employed	Hammers								Total
	0–5	6–10	11–15	16–20	21–25	26–30	31–35	36+	
0– 25 ...	18	8	1	—	—	—	—	—	27
26– 50 ...	5	12	1	1	—	—	—	—	19
51– 100 ...	7	8	11	4	3	1	—	—	34
101– 150 ...	3	7	5	3	1	—	—	—	19
151– 200 ...	2	2	2	2	2	—	1	2	13
201– 300 ...	2	1	3	5	—	—	—	2	13
301– 400 ...	3	3	1	—	—	1	—	3	11
401– 500 ...	2	3	1	—	—	—	1	1	8
501–1000 ...	3	2	1	1	—	1	2	2	12
1001+... ...	3	5	4	4	3	1	2	2	24
Total	48	51	30	20	9	4	6	12	180

TABLE 3*

QUESTION Are man cooling fans provided where necessary?
Are furnaces etc., heat insulated?
Have any measures been taken to provide protection against noise?

No. Employed	Man Fans Provided			Furnaces Insulated		Noise Measures Introduced	
	Yes	No	N/A	Yes	No	Yes	No
	%	%	%	%	%	%	%
0– 25 ...	12	48	40	44	56	16	84
26– 50 ...	22	53	25·3	53	47·5	22	78
51– 100 ...	32·4	44·2	23·5	64·7	35·3	35·3	64·7
101– 150 ...	33·3	44·4	22·2	61·2	38·9	16·6	83·2
151– 200 ...	66·6	33·3	—	50	50	41·6	58·3
201– 300 ...	50	33·3	16·6	66·6	33·3	41·6	58·3
301– 400 ...	54·6	36·4	9·1	63·7	36·4	18·2	81·9
401– 500 ...	57·2	42·8	—	42·8	57·2	28·6	71·4
501–1000 ...	58	16·6	25	83·3	16·6	16·6	83·3
1001+	26·1	39·2	34·8	65·3	34·8	17·4	82·6
ALL	35·2	41	23·7	59	41	15	85

TABLE 4*

QUESTION What type of floor is provided in the forge?

No. Employed	Steel Plate and Concrete	Steel Plate Brick and Concrete	Concrete	Brick and Concrete	Brick	Steel Plate	Earth and Concrete	Earth and Brick	Earth
	%	%	%	%	%	%	%	%	%
0– 25 ...	4	4	72	8	4	—	—	—	8
26– 50 ...	10·5	—	68·5	—	5·3	—	10·5	5·3	—
51– 100 ...	8·8	2·9	79·4	—	—	2·9	5·9	—	—
101– 150 ...	16·6	—	38·9	11·1	—	—	33·3	—	—
151– 200 ...	16·6	—	75	—	—	—	—	—	8·3
201– 300 ...	16·6	—	58·3	16·6	—	—	—	—	8·3
301– 400 ...	27·3	—	45·5	9·1	—	9·1	—	—	9·1
401– 500 ...	85·7	—	14·3	—	—	—	—	—	—
501–1000 ...	41·6	—	58·4	—	—	—	—	—	—
1001+	34·8	13·1	34·8	—	—	4·4	8·7	—	4·4
ALL	20·1	2·9	59	4·1	1·2	1·7	6·9	·5	3·5

* Because of the rounding of figures independently some cross-totals may not add to 100 per cent.

TABLE 4A*

QUESTION What standard of maintenance of floors is provided?

No. Employed	A†	B†	C†	D†	E†
	%	%	%	%	%
0– 25	4	32	32	32	—
26– 50	—	53	36·8	10·5	—
51– 100	5·9	41·3	50	2·9	—
101– 150	—	16·6	61·2	22·2	—
151– 200	8·3	33·3	25	41·69	—
201– 300	—	41·6	16·6	33·3	—
301– 400	—	36·4	54·6	9·1	—
401– 500	—	71·4	28·6	—	—
501–1000	16·6	58·3	25	—	—
1001+	4·4	34·8	47·9	13·1	—
ALL	4	39·4	40·1	16·5	—

TABLE 5*

QUESTION What standard of natural and artificial lighting is provided?

No. Employed	Natural					Artificial				
	A†	B†	C†	D†	E†	A†	B†	C†	D†	E†
	%	%	%	%	%	%	%	%	%	%
0– 25 ...	4	36	48	12	—	—	16	56	28	—
25– 50 ...	—	25·3	58·3	15·8	—	—	31·5	63·2	5·3	—
51– 100 ...	5·9	35·3	38·3	20·6	—	—	23·5	67·6	8·3	—
101– 150 ...	5·6	27·8	50	16·6	—	5·6	5·6	88·8	—	—
151– 200 ...	8·3	25	50	8·3	8·3	—	25	58·3	16·6	—
201– 300 ...	—	50	41·6	8·3	—	—	25	50	25	—
301– 400 ...	9·1	36·4	18·2	—	—	—	36·4	54·6	9·1	—
401– 500 ...	—	71·4	14·3	14·3	—	—	42·8	57·2	—	—
501–1000 ...	16·6	8·3	58·3	16·6	—	—	50	41·6	8·3	—
1001+	4·4	26·1	43·5	26·1	—	—	34·8	43·5	21·4	—
ALL	5·2	32·4	45	16·7	·6	·6	26·6	59·9	13·3	—

* See footnote on page 46.

† See page 44.

TABLE 6*

QUESTION What standard of general ventilation has been provided?

Has satisfactory local exhaust ventilation been provided to remove fumes from heaters, furnaces etc.?

No. Employed	General Ventilation					Local Exhaust Provided	
	A†	B†	C†	D†	E†	Yes	No
	%	%	%	%	%	%	%
0– 25 ...	8	32	60	—	—	32	68
26– 50 ...	—	47·5	53	—	—	10·5	89·5
51– 100 ...	2·9	47·1	47·1	2·9	—	23·5	76·5
101– 150 ...	5·6	55·6	38·9	—	—	55·6	44·4
151– 200 ...	—	66·6	25	8·3	—	25	75
201– 300 ...	—	75	25	—	—	8·3	91·6
301– 400 ...	9·1	54·6	36·4	—	—	45·5	54·6
401– 500 ...	14·3	71·4	14·3	—	—	14·3	85·7
501–1000 ...	16·6	41·6	33·3	8·3	—	58·3	41·6
1001+	—	52·2	39·2	8·7	—	39·2	61·8
ALL	4·6	50·8	41·6	2·9	—	31	69

TABLE 7*

QUESTION What standard of housekeeping inside and outside the forge is maintained?

No. Employed	A†		B†		C†		D†		E†	
	In-side	Out-side	In-side	Out-side	In-side	Out-side	In-side	Out-side	In-side	Out-side
	%	%	%	%	%	%	%	%	%	
0– 25	—	—	16	20	56	60	24	20	4	—
26– 50	—	—	36·8	47·5	47·5	53	15·8	—	—	—
51– 100	—	2·9	35·3	55·9	55·9	41·3	8·8	—	—	—
101– 150	—	—	11·1	38·9	61·2	55·6	22·2	5·6	5·6	—
151– 200	—	—	41·6	50	50	50	8·3	—	—	—
201– 300	8·3	—	41·6	58·3	41·6	25	8·3	16·6	—	—
301– 400	—	—	54·6	63·7	18·2	27·3	27·3	9·1	—	—
401– 500	—	14·3	85·7	85·7	14·3	—	—	—	—	—
501–1000	16·6	25	41·6	33·3	25	41·6	16·6	—	—	—
1001+ ...	4·4	4·4	30·5	43·5	56·6	47·9	8·7	4·4	—	—
ALL ...	2·5	3·8	37·5	51	52·5	44·5	15	6·3	1·3	—

* See footnote on page 46.

† See page 44.

TABLE 8*

QUESTION Are gangways and working spaces sufficiently large and unobstructed?

No. Employed	Good	Adequate	Bad
	%	%	%
0– 25	60	8	32
26– 50	68·5	22	10·5
51– 100	67·6	17·6	14·7
101– 150	88·8	—	11·1
151– 200	83·3	16·6	—
201– 300	83·3	16·6	—
301– 400	72·8	—	27·3
401– 500	100	—	—
501–1000	83·3	8·3	8·3
1001+	73·9	8·7	17·4
ALL	74·5	11	14·5

TABLE 9*

QUESTION What is the standard of general cleanliness in forges?
What is the standard of compliance with Section 1, Factories Act 1961

No. Employed	General Cleanliness					Compliance with Sec. 1	
	A†	B†	C†	D†	E†	Yes	No
	%	%	%	%	%	%	%
0– 25 ...	—	8	68	20	4	68	32
26– 50 ...	—	42·2	42·2	15·8	—	73·7	25·3
51– 100 ...	2·9	38·3	52·9	5·9	—	85·3	14·7
101– 150 ...	—	22·2	55·6	22·2	—	72·2	27·8
151– 200 ...	—	33·3	58·3	8·3	—	50	50
201– 300 ...	—	50	33·3	16·6	—	58·3	41·6
301– 400 ...	—	45·5	36·4	18·2	—	72·8	27·3
401– 500 ...	—	71·4	14·3	14·3	—	85·7	14·3
501–1000 ...	16·6	41·6	25	16·6	—	83·3	16·6
1001+	—	30·5	43·5	26·1	—	56·6	43·5
ALL	1·7	34	47·5	16·2	·6	71	29

* See footnote on page 46.

† See page 44.

TABLE 10*

QUESTION Is there at least one wash-basin for every ten forge workers?
What is the standard of maintenance of washing facilities?
Are baths or showers provided?

No. Employed	1: 10 Basins		Maintenance of Washing Facilities					Baths Provided	
	Yes	No	A†	B†	C†	D†	E†	Yes	No
	%	%	%	%	%	%	%	%	%
0– 25 ...	80	20	4	12	60	12	12	8	92
26– 50 ...	84·2	15·8	—	31·5	42·2	22	5·3	22	78
51– 100 ...	76·5	23·5	5·9	50	35·3	5·9	2·9	41·3	58·8
101– 150 ...	88·8	11·2	—	33·3	55·6	5·6	5·6	33·3	66·6
151– 200 ...	83·3	16·6	—	50	25	16·6	8·3	50	50
201– 300 ...	100	—	33·3	41·6	25	—	—	33·3	66·6
301– 400 ...	72·8	27·2	18·2	54·6	27·3	—	—	54·6	45·4
401– 500 ...	71·4	28·6	—	42·8	57·2	—	—	42·8	57·2
501–1000 ...	100	—	16·6	41·6	41·6	—	—	41·6	58·4
1001+ ...	91·4	8·6	8·6	56·6	30·5	4·4	—	73·9	26·1
ALL	84·4	15·6	7·5	40·5	40·5	7·5	4	38·7	61·3

TABLE 11*

QUESTION Is a first-aid room provided?
Is clothing accommodation provided?
What is the standard of clothing accommodation?

No. Employed	First-aid Room		Clothing Accommodation Provided		Maintenance of Clothing Accommodation				
	Yes	No	Yes	No	A†	B†	C†	D†	E†‡
	%	%	%	%	%	%	%	%	%
0– 25 ...	8	92	56	44	—	4	32	20	44
26– 50 ...	25·3	73·7	68·5	31·5	—	15·8	36·8	15·8	31·5
51– 100 ...	50	50	67·6	32·4	8·8	26·5	29·4	2·9	32·4
101– 150 ...	88·8	11·2	88·8	11·2	—	16·6	50	16·6	16·6
151– 200 ...	100	—	91·6	8·4	—	33·3	41·6	16·6	8·3
201– 300 ...	100	—	75	25	25	8·3	33·3	8·3	25
301– 400 ...	91	9	81·9	18·1	9·1	18·2	45·5	9·1	18·2
401– 500 ...	100	—	42·8	57·2	—	28·6	14·3	—	57·2
501–1000 ...	100	—	91·6	8·4	16·6	41·6	16·6	16·6	8·3
1001+ ...	100	—	95·6	4·4	17·4	21·4	39·2	8·7	13·1
ALL	69·1	30·9	75·7	24·2	7·5	20·1	34·6	11·6	26

* See footnote on page 46.

† See page 44.

‡ E marking given where no accommodation provided.

TABLE 12*

QUESTION Is a messroom or canteen provided?
What is the standard provided?

No. Employed	Provided		Standard				
	Yes	No	A†	B†	C†	D†	E†‡
	%	%	%	%	%	%	%
0– 25 ...	24	76	—	8	12	—	80
26– 50 ...	53	47	—	22	22	5·3	53
51– 100 ...	55·9	44·2	—	20·6	26·5	8·8	41·3
101– 150 ...	94·4	5·6	—	38·9	55·6	—	5·6
151– 200 ...	100	—	8·3	50	41·7	—	—
201– 300 ...	100	—	25	58·3	16·7	—	—
301– 400 ...	100	—	9·1	63·7	36·4	—	—
401– 500 ...	100	—	—	57·2	42·8	—	—
501–1000 ...	100	—	16·6	50	33·4	—	—
1001+	100	—	8·7	56·6	30·5	4·4	—
ALL	74·6	25·4	5·2	36·4	29·5	2·9	26

TABLE 13*

QUESTION Is anyone specifically appointed to exercise safety supervision?
Was the management aware of the J.S.C. Report of 1953?
Has any conscious effort to follow its recommendations been made?

No. Employed	Safety Supervision		Aware of Report		Followed Report	
	Yes	No	Yes	No	Yes	No
	%	%	%	%	%	%
0– 25 ...	16	84	48	52	16	84
26– 50 ...	10·5	89·5	47·5	52·5	31·5	68·5
51– 100 ...	29·4	70·6	44·2	55·9	29·4	70·6
101– 150 ...	38·9	61·2	66·6	33·3	27·8	72·2
151– 200 ...	33·3	66·6	66·6	33·3	33·3	66·6
201– 300 ...	50	50	58·3	41·7	41·7	58·3
301– 400 ...	45·5	54·5	36·4	63·6	9	91
401– 500 ...	42·8	57·2	85·7	14·3	85·7	14·3
501–1000 ...	66·6	33·3	75	25	33·3	66·6
1001+ ...	73·9	26·1	65·3	34·7	38·2	61·8
ALL ...	38·2	61·8	56·2	43·8	31·3	68·7

* See footnote on page 46.

† See page 44.

‡ E marking given where messroom not provided.

TABLE 14*

QUESTION Are suitable arrangements made for compliance with section 13 Factories Act 1961?

Are overhead gangways or platforms provided with guard-rails and toeboards?

What arrangements are made for inspecting and overhauling hammers?

	Section 13		Guarding of Platforms				Maintenance of Hammers				
No. Employed	Yes	No	Guard-rails and Toe-boards	Guard-rails Only	Neither	N/A	Daily	Weekly	2 Week	Monthly	As Neces-sary
	%	%	%	%	%	%	%	%	%	%	%
0– 25 ...	100	—	4	20	4	72	16	48	4	4	28
26– 50 ...	100	—	31·5	15·8	5·3	47·5	10·5	63·2	—	5·3	22
51– 100 ...	100	—	17·6	58·3	5·9	17·6	26·5	44·2	—	8·8	20·6
101– 150 ...	100	—	44·4	33·3	5·6	16·6	33·3	50	—	5·6	11·1
151– 200 ...	91·6	8·4	8·4	50	—	41·6	25	66·6	—	—	8·4
201– 300 ...	91·6	8·4	25	58·4	—	16·6	8·4	75	—	—	16·6
301– 400 ...	100	—	54·6	27·3	—	18·2	27·3	45·5	—	9·1	18·2
401– 500 ...	100	—	14·3	57·2	—	28·6	14·3	85·7	—	—	—
501–1000 ...	100	—	25	41·6	—	33·3	16·6	75	—	—	8·4
1001+ ...	91·4	8·6	52·2	34·8	—	13	43·5	34·8	—	—	21·4
ALL ...	98·4	1·6	27·1	38·7	2·9	31·1	23·7	53·7	·6	4	18

* See footnote on page 46.

TABLE 15*

QUESTION What types of props and catches are provided?

(Figures refer to illustration numbers in Safety, Health and Welfare, New Series Booklet No. 12, 1963 edition)

No. Employed	1	2	3	4	5	6	7	8	Tied Metal	Tied Wood	Loose Metal	Loose Wood	None
	%	%	%	%	%	%	%	%	%	%	%	%	%
0– 25 ...	—	8	4	12	52	—	—	—	—	16	16	28	12
26– 50 ...	—	—	—	10·5	25·3	—	—	—	—	10·5	10·5	36·8	15·8
51– 100 ...	—	29·4	5·9	5·9	26·5	8·8	2·9	2·9	11·8	14·7	14·7	41·3	2·9
101– 150 ...	—	27·8	—	5·6	27·8	—	—	5·6	—	11·1	11·1	38·9	5·6
151– 200 ...	—	16·6	25	8·4	16·6	—	—	8·4	—	—	—	41·6	8·4
201– 300 ...	16·6	25	8·4	16·6	25	—	—	—	—	—	—	50	8·4
301– 400 ...	—	9·1	9·1	9·1	18·2	—	—	—	—	9·1	9·1	36·4	27·3
401– 500 ...	—	57·2	14·3	—	14·3	—	—	—	—	—	—	—	28·6
501–1000 ...	8·4	41·6	—	8·4	16·6	—	8·4	8·4	—	16·6	16·6	41·6	16·6
1001+ ...	—	26·1	8·7	8·7	13·1	4·4	4·4	21·4	—	13·1	13·1	39·2	8·7
ALL	1·7	22	6·3	8·7	26	2·3	1·7	5·2	2·3	11	11	37	11

* See footnote on page 46.

TABLE 16*

QUESTION Are guards provided for treadles?
Are scale guards provided?
Are hands or arms placed between dies during lubrication?

No. Employed	Treadle Guards				Scale Guards			Hands between Dies	
	Yes	Some	No	N/A	Yes	Some	No	Yes	No
	%	%	%	%	%	%	%	%	%
0– 25 ...	—	4	56	40	20	8	72	8	92
26– 50 ...	15·8	5·3	58·3	22	22	15·8	63·2	—	100
51– 100 ...	17·6	26·5	41·3	14·7	35·3	25·3	41·3	2·9	97·1
101– 150 ...	22·2	5·6	16·6	56·6	27·8	11·1	61·2	11·2	88·8
151– 200 ...	50	8·4	16·6	25	33·3	25	41·6	8·4	91·6
201– 300 ...	—	25	58·3	16·7	16·7	25	58·3	8·4	91·6
301– 400 ...	9·1	18·2	63·7	9·1	36·4	9·1	54·6	—	100
401– 500 ...	28·6	—	57·2	14·2	14·3	14·3	71·4	—	100
501–1000 ...	25	16·6	33·3	25	33·3	8·4	58·3	—	100
1001+ ...	39·2	—	52·2	8·7	43·5	4·4	52·2	—	100
ALL	19·7	11·6	45·2	23·7	29·5	14·5	56	4	96

TABLE 17*

QUESTION Are suitable tongs provided?
What is the standard of condition of hand tools generally?

No. Employed	Suitable Tongs		Standard of Hand Tools				
	Yes	No	A†	B†	C†	D†	E†
	%	%	%	%	%	%	%
0– 25 ...	100	—	—	52	40	8	—
26– 50 ...	100	—	—	68·5	31·5	—	—
51– 100 ...	97·1	2·9	—	52·9	41·3	5·9	—
101– 150 ...	100	—	—	33·3	61·2	5·5	—
151– 200 ...	100	—	—	58·3	41·7	—	—
201– 300 ...	100	—	—	58·3	41·7	—	—
301– 400 ...	100	—	—	63·7	36·3	—	—
401– 500 ...	100	—	—	85·7	14·3	—	—
501–1000 ...	100	—	—	66·6	33·4	—	—
1001+	100	—	—	52·1	43·5	4·4	—
ALL	99·4	·6	—	56	40·5	3·5	—

* See footnote on page 46.

† See page 44.

Table 18*

Question Is eye protection provided for persons employed at hammers and stamps?
What is the approximate percentage of such workers using eye protection?

No. Employed	Eye Protection Provided		Percentage Used				
	Yes	No	None	1–25%	26–50%	51–75%	76–100%
	%	%	%	%	%	%	%
0– 25 ...	45	52	100	—	—	—	—
26– 50 ...	47·5	52·5	78	10·5	5·3	—	5·3
51– 100 ...	70·6	29·4	55·9	32·4	8·8	2·9	—
101– 150 ...	61·2	38·9	66·6	22·2	5·6	—	5·6
151– 200 ...	66·6	33·3	41·6	50	—	—	8·4
201– 300 ...	75	25	50	41·6	8·4	—	—
301– 400 ...	81·9	18·1	54·6	36·4	9·1	—	—
401– 500 ...	85·7	14·3	14·3	71·4	—	—	14·3
501–1000 ...	91·6	8·4	41·6	41·6	—	8·3	8·3
1001+	91·4	8·7	39·2	43·5	8·7	4·4	4·4
ALL	69·4	30·6	59·5	30·1	5·2	1·7	3·5

Table 19*

Question What other protective clothing is provided and used?
Is fire-proof clothing provided?

No. Employed	Other Protective Clothing							Fire-proof	
	Gloves	Aprons	Fire-proof Aprons	Gauntlets	Spats	Helmets	Overalls	Yes	No
	%	%	%	%	%	%	%	%	%
0– 25 ...	60	16	4	4	—	4	—	4	96
26– 50 ...	58·3	25·3	5·3	10·5	5·3	5·3	10·5	15·8	84·2
51– 100 ...	70·6	29·4	17·6	8·8	5·9	—	8·8	38·3	61·8
101– 150 ...	50	27·8	27·8	5·6	—	5·6	16·6	33·3	66·6
151– 200 ...	75	41·6	8·4	33·3	—	8·4	8·4	16·6	83·4
201– 300 ...	75	16·6	33·3	8·4	8·4	8·4	8·4	33·3	66·6
301– 400 ...	63·7	54·6	9	—	9	—	—	9	91
401– 500 ...	71·4	28·6	57·2	71·4	14·3	14·3	—	42·8	57·2
501–1000 ...	66·6	25	41·6	25	25	16·6	—	33·3	66·7
1001+ ...	69·6	61·8	4·4	8·7	4·4	4·4	4·4	17·4	82·6
ALL	65·5	32·4	16·8	12·7	5·8	5·2	6·4	23·5	76·5

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* See footnote on page 46.

TABLE 20*

QUESTION Does the firm have a safety boot scheme?
What is the approximate percentage of workers using scheme?

No. Employed	Safety Boot Scheme		Percentage Using Scheme				
	Yes	No	None	1–25%	25–50%	51–75%	76–100%
	%	%	%	%	%	%	%
0– 25 ...	36	64	68	16	—	4	12
26– 50 ...	31·5	68·5	68·5	15·8	5·3	5·3	5·3
51– 100 ...	44·2	55·8	61·8	11·8	5·9	2·9	26·5
101– 150 ...	61·2	38·8	38·8	5·6	27·8	27·8	—
151– 200 ...	75	25	25	16·6	33·3	8·3	16·6
201– 300 ...	75	25	25	33·3	—	16·6	25
301– 400 ...	100	—	—	36·4	36·4	18·2	9·1
401– 500 ...	100	—	—	57·2	14·3	14·3	14·3
501–1000 ...	91·6	8·4	16·6	25	16·6	—	41·6
1001+	91·4	8·6	8·6	34·8	26·1	4·4	26·1
ALL	63	37	39·3	21·2	14·4	8·7	16·2

TABLE 21*

QUESTION What means of mechanical handling are used for transfer of materials and forgings?

No. Employed	Fork-lift Trucks	Cranes	Run-ways	Mechanical Trucks	Con-veyors	Furnace Mani-pulators	Dum-pers	Hand Trucks or Wheel-barrows	None
	%	%	%	%	%	%	%	%	%
0– 25 ...	16	8	—	—	—	—	—	8	76
26– 50 ...	42·2	22·1	5·3	5·3	—	—	—	15·8	31·5
51– 100 ...	64·7	14·7	8·3	11·8	11·8	—	—	11·8	20·6
101– 150 ...	50	22·2	—	27·8	5·6	5·6	11·1	27·8	—
151– 200 ...	75	41·6	8·4	25	—	16·6	—	—	8·4
201– 300 ...	75	33·3	25	25	16·6	—	—	16·6	8·4
301– 400 ...	45·5	45·5	9·1	27·3	—	—	—	18·2	9·1
401– 500 ...	100	42·8	—	42·8	—	—	—	—	—
501–1000 ...	58·3	41·6	8·4	8·4	33·3	8·4	—	16·6	16·6
1001+ ...	56·6	43·5	4·4	30·5	4·4	4·4	—	8·7	8·7
ALL	53·7	27·2	6·4	17·3	7	2·9	1·1	12·7	22·6

* See footnote on page 46.

TABLE 22*

QUESTION What improvements have been made in safety, health and welfare since 1953 ?

No. Employed	Major Improvements	Minor Improvements	None
	%	%	%
0– 25	8	20	72
26– 50	15·8	36·8	47·5
51– 100	26·5	35·3	38·3
101– 150	11·1	50	38·9
151– 200	16·6	41·6	41·6
201– 300	8·4	58·3	33·3
301– 400	—	27·3	72·8
401– 500	—	36·4	57·2
501–1000	—	83·3	16·6
1001+	21·4	52·2	26·2
ALL	13·9	42·8	43·3

* See footnote on page 46.

APPENDIX VIII

Bibliography

SAFETY, HEALTH AND WELFARE PUBLICATIONS

A Selection of New Series Booklets

No.		*Price*
1.	Lifting and Carrying	1s.
2.	Canteens, Messrooms and Refreshment Services	3s.
4.	Safety in the Use of Abrasive Wheels	4s.
5.	Cloakroom Accommodation and Washing Facilities in Factories	In prep.
8.	Dust and Fumes in Factory Atmospheres	2s.
10.	Fire Fighting in Factories	2s.
12.	Safety at Drop-Forging Hammers	In prep.
14.	Safety in the Use of Mechanical Power Presses	4s.
16.	The Structural Requirements of the Factories Act	2s.
18.	Industrial Dermatitis: Precautionary Measures	1s. 3d.
25.	Noise and the Worker	1s. 3d.
28.	Plant and Machinery Maintenance	3s.
36.	First Aid in Factories	In prep.

Obtainable from H.M. Stationery Office

British Standards Specification No. 1547 (1959) Flameproof Industrial Clothing Materials and Design	3s.

Obtainable from British Standards Institution,
2 Park Street, London, W.1

Safety Rules for Employees in the Drop Forging Industry	2s. 6d.
Protective Clothing for Workers in the Drop Forging Industry	—
Fire Precautions in Drop Forges	—

Obtainable from
National Association of Drop Forgers and Stampers,
Grove Hill House, 245 Grove Lane, Birmingham 20.

Printed in England for Her Majesty's Stationery Office by Courier Printing Co. Ltd., Tunbridge Wells.
Dd126340 K/6 7/66 (NT Gp. 497)

MINISTRY OF LABOUR

CONDITIONS IN THE DROP FORGING INDUSTRY

1954-1964

Report of The Joint Standing Committee
on Health, Safety and Welfare in
The Drop Forging Industry

1966

LONDON
HER MAJESTY'S STATIONERY OFFICE
1966

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New text, which was not published in the 1953 Report of the Committee, has been indicated in these Appendices by a heavy marginal line. The tables in Appendices IF and VII have not previously been published.

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* Members indicated thus served on the original Committee. The Committee wishes to acknowledge the assistance of various Members of the Industry, Unions and Factory Inspectorate who have served upon the Committee over the past 10 years.